The

Electrical Review

VOL. XCIX. DECEMBER 31, 1926. No. 2,562.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

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Telegraphic Address "AGEEKAY, CENT., LONDON," Code, A B C. Telephone No.: Central 7072 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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An Invitation to Birmingham.

WE hope that every reader, when he receives this copy of the ELECTRICAL REVIEW, will take possession of the Invitation Voucher which will be found loosely inserted at the request of the Birmingham Committee of the British Industries Fair, for the convenience of visitors to the Electrical Trade Section (February 21st to March 4th).

This invitation card is expressly circulated *for use*, and if, through accident, it is missing from the REVIEW received by any trade reader, we hope that he will at once communicate with us so that we may repair the omission. It should be noted that the card is of value to the recipient because of the railway travel concession which it confers upon all visitors to the Fair either in Birmingham or in London; it also gives the train and motor-'bus service times to and from Castle Bromwich.

This particular distribution date has been chosen so that readers abroad may be reached in good time. Those who receive the card just when they are preparing to depart for these shores should bring it with them; our Home readers should file it carefully for use in February.

We have already said all that there is to say at present regarding the assured success of the Electrical Fair of 1927 from the standpoint of representativeness of character. Some weeks ago we urged our friends in the Colonies and abroad to book the date. We are anxious to do everything in our power to induce a large number of electrical buyers to so time their visits to this country as to enable them to inspect and purchase British electrical products at the one centre where special market preparations are being made.

We offered our full co-operation to the Birmingham Electrical Committee and the Department of Overseas Trade, and the most convenient kind of co-operation has proved to be the use of this Journal as a connecting link by circulating this Invitation Voucher with the REVIEW itself to every reader through whatever channel he may receive the paper. We have been building up a foreign circulation ever since we began to be in 1872. In the first year of our existence we had agents representing the sale of the REVIEW in the U.S.A., France, Germany, and Peru, and to-day we go everywhere where electrical men gain a livelihood. We hope that the use of the specialised circulation peculiar to this Journal will afford valuable assistance supplementing the efforts of the D.O.T. and the Birmingham Committee. Through our mailing list and our other circulation channels we want this Invitation Card to be the means of introducing buyer and seller at Birmingham seven or eight weeks hence.

The Standardisation of Voltage.

THE excellent paper on "City Electricity Distribution Systems," which was read before the I.E.E. by Messrs. J. R. Beard and T. G. N. Haldane (abstracted in our issue of November 12th), dealt with the standardisation of low- and high-voltage networks, and was cordially welcomed as outlining ideals which should be aimed at by electricity supply engineers. Incidentally, it raised the question of standardising the consumers' supply pressure, which is in fact one of the most important problems before the industry. The British Engineering Standards Association, after full investigation, has recommended 400 V between phases and 230 V between phase and neutral for three-phase systems, and the Electricity Commissioners have adopted those values for all new undertakings; the corresponding voltages for d.c. three-wire supply will, of course, be 460/230 V, so that all lamps and other consuming apparatus installed in domestic households will be rated at 230 V.

In the United States, pressures of 105, 110, or 115 V are practically universal; hence the difficulties in this respect with which British manufacturers and retailers have to contend are there unknown, but on the other hand the supply authorities have been handicapped by the lowness of the pressure, which has involved the use of enormous quantities of copper in their distributing mains, and they would gladly double the pressure if it were feasible.

In this country, on the other hand, according to the Electricity Commissioners' Return of Engineering and Financial Statistics for 1924-25, supplies were being given at the end of that period at 32 different voltages ranging from 100 to 480 V, a.c., and at 23 voltages d.c.; the collective figure for both classes of supply, including associated pairs of voltages, was 38. Moreover, 168 undertakings were operating with three or more declared pressures ranging from 100 to 480 V, 88 with four or more, and 19 with five or more different declared pressures.

This is certainly a deplorable state of affairs, and unfortunately there is no remedy in sight. The Electricity (Supply) Act does not in any way affect it, as the Act deals only with high-pressure generation, and does not touch distribution problems at all, except incidentally in connection with the standardisation of frequency (for a different purpose—that of interlinking). Nevertheless the voltage chaos is a matter of the first importance. According to the recent report of the Economic Sub-Committee to the Imperial Conference, if we could standardise our supply pressure, the value of the stocks of electric lamps which are held outside factories in Great Britain, estimated at four million pounds, could be cut down to one-half of that amount—and similar advantages would result in the case of other consuming devices. Moreover, the consumers themselves would profit, not only by the consequent cheapening of manufacture, but also by the removal of the annoyance they experience when moving from one district to another, where the declared pressure is different from that prevailing in the former.

In the days of the carbon lamp, when it was impossible to manufacture the lamps precisely to suit a given voltage, the existence of a range of pressures differing from one another by a small percentage was doubtless a commercial convenience; but nowadays, when metal-filament lamps can be made exactly to standard, the variety of voltages offers no advantage even to the lamp makers. Some 250 undertakings already operate at 230 V; other 164, all d.c., use 220 or 240 V, and could probably come into line without incurring prohibitive expense. A move in this direction would be at least as beneficial as the standardisation of frequency contemplated by the Government.

Reflections on 1926.

TO-DAY we ring down the curtain upon a year the greater part of which, in the terms of the King's Prorogation Speech, has been lived in the shadow of the most protracted and ruinous industrial conflict in history. When the year opened we alluded to the general improvement in the outlook, notwithstanding the serious industrial problems that were threatening. Unemployment was falling and trade was improving, and if industrial conflict could have been avoided, the nation would have been hundreds of millions of pounds better off to-day. But the challenge came and the Nation flinched not. Now we have to repair the breaches in the wall, and for some time to come every man amongst us, from the highest to the lowest, will have to pay the bill in some way or other. We close the year, however, looking forward rather than backward, and it seems sound to suggest that the new work that the end of the struggle has released, and the larger volume that is in contemplation, should bring about gradually-increasing activity in practically all our great industries. In this way prosperity and employment should return, but it is idle to anticipate a very early absorption of the million and more unemployed. The King's Speech included a reference to the duty of all to unite in effacing bitter memories and setting our eyes steadfastly upon the future, inspired by a common impulse toward genuine fellowship and sustained endeavour, upon which alone prosperity and happiness can be firmly based. We need not stay to explain why this is all true; it is none the less true because the pious aspiration has been expressed so often in the past. If only we would and could all get to work, and work with a will, the return to prosperity would be made more rapidly.

It is one of the singular coincidences of the year that industrial strife was proceeding amongst us here on an unparalleled scale at the very time that Ministers from all parts of the Dominions and Representatives of the Empire of India were engaged in conference with us in London trying to find ways of ensuring a better prospect for the whole of the peoples of the Empire. Many economic matters came under review, questions of the development and utilisation of the resources of different parts of the Empire along co-ordinated lines, the development of inter-Imperial trade relations, and so forth. Out of all these deliberations it may be hoped that great good will ultimately come, though no immediate substantial headway could be made this time. There have been exhaustive studies and discussions at such conferences again and again with disappointing results. While nothing tangible has emerged from the 1926 Conference, it is believed that the foundations have been laid upon which an actual edifice may be reared next time. We would that this work could be hastened, for the development by, and peopling of the Empire with, our own folk seems to promise, taking the long view, a large part of the way out of the Mother Country's tribulations. Though the Conference achieved little of immediate industrial value, it should be remarked that Mr. Bruce, the Prime Minister of Australia, in a broadcast speech from London, said that as the "internal Imperial political problem" had almost disappeared as a result of the Imperial Conference, it would at future gatherings be possible "to concentrate their attention upon those economic problems which concerned the welfare of their people." He concluded by urging Britain to do everything in her power to assist the growth and development of the Empire so that that Empire could buy more British goods.

If we turn from these larger national industrial considerations, which necessarily have a prominent place in our thoughts at the end of so exceptional a year, to the position of the electrical engineering industries, we are at once met with an invigorating breeze which will carry us into the New Year full of optimism for everything and everybody electrical.

Tramways in 1925-26.

THE return of tramways and light railways (including railless trolley systems) for the year 1925-26 is reviewed in this issue. It will be seen that in spite of increasing motor-omnibus competition, the number of passengers carried by tramways again increased, although the proportional increase was less than that of the car-mileage. This, however, is not a bad sign; three or four years ago we showed that, during and since the war, the number of passengers had increased abnormally as compared with the car-mileage, a circumstance indicative of overcrowding.

Such change as there was in the financial position was mainly for the better, although the operating ratio again increased. It is worth noting that in 1913-14 the ratio of expenses to receipts was only 64.51 per cent., but it has gradually risen until it reached 80.10 per cent. during the year under review. There was a decided improvement in the situation of the municipal undertakings. The three "upper" classes increased by six, while the three lower ones lost three undertakings. Moreover, the debtor balance shown by the combined systems was reduced from £282,907 to £211,135, and the excess amount drawn from the rates above the total contributed thereto was only £76,881, as compared with £240,069 in 1924-25. As we have previously pointed out, these undertakings are not primarily profit-making concerns; they aim at meeting expenses as closely as possible. We see nothing in the return to strengthen the case of those who are pressing for the abolition of tramways. If they were not compelled to work under very onerous conditions and were protected against competition which is often of an irresponsible nature, we feel sure that tramways would not only continue to fulfil duties which other modes of transport cannot satisfy, but would pay their way.

The Operation of a Coal Clause.

WITH coal at famine prices, during the stoppage of the output from British mines, many electricity supply authorities were compelled to raise their charges, and various methods were adopted for this purpose. Some charged the extra cost of fuel per kWh against each class of tariff—raising, say, a lighting rate of 6d. to 6½d. and a heating rate of 1½d. to 2d.; others added a fixed percentage to each item, with a very different result—for instance, an addition of 10 per cent. to the above prices would make them 6.6d. and 1.65d. respectively. The former method appears to be the more equitable, but the latter was more generally adopted. Where a two-part tariff was in force, the obviously correct course was to increase the unit charge only, as the fixed charges were not materially affected by the price of coal.

A case has been brought to our notice in which the existence of a "coal clause" in an agreement for the supply of electricity to a factory had the effect of adding more than twice the additional cost of the coal to the monthly bill for energy, and actually doubled the account. Remonstrances were of no avail—it was in the bond.

It is one thing to secure fair compensation for exceptional and unavoidable outlay, but quite another thing to make a large profit out of the circumstances. "Profiteering" is highly unpopular amongst the victims, and we feel that unjust charges such as this appears to be should not be made—they do serious harm to electricity supply and, in the long run, to the supplier.

Illumination and Efficiency in Fine Work.

THE report issued jointly by the Medical Research Council and the Department of Scientific and Industrial Research on the above subject, to which reference was recently made in the ELECTRICAL REVIEW, was awaited with much curiosity. It is undoubtedly one of the most important of the series of reports being issued by the Illumination Research Committee, for it contains the first authoritative and official data obtained in this country on the relation between illumination and efficiency in industrial work. We are aware that data purporting to show that better lighting leads to improved production have been collected by various undertakings in the United States; but in this country very few definite data have hitherto been available. No exception can be taken to the authoritative and impartial nature of this inquiry, and the results are proportionately valuable. The Committee was thoroughly representative, the experimenters were doubtless the best that could have been selected, and the co-operation of the Joint Industrial Council for the Printing and Allied Trades ensured that the methods corresponded with actual practical conditions in the printing industry. The hand-setting of type was selected as a typical example of "fine" work.

Broadly, the research leads to the conclusion that full efficiency is only attained with an illumination approaching 20 foot-candles. This conclusion would doubtless apply to many other forms of fine work, and it furnishes a most potent argument for better industrial lighting. As regards the lower limit, it is interesting to observe that when the illumination was diminished to 1.3 foot-candles the operators were so conscious of fatigue that they could only with difficulty be persuaded to continue work on the second day of test! Yet we should not be surprised to find that in many printing offices the illumination is not so very much more than this—certainly there are still comparatively few works in which the full economical illumination of, say, 20 foot-candles is attained.

Electricity in Mines.

ELSEWHERE in this issue we summarise the report for 1925 of the Electrical Inspector of Mines (Mr. J. A. B. Horsley), to which we briefly referred last week. It appears that out of 2,721 mines at work at the end of 1925, 1,589 were using electricity; the total horse-power of motors installed was 1,556,235 h.p.—an increase over 1924 of 74,303 h.p. In 1921, 51.8 per cent. of mines at work were using electricity; last year the proportion had increased only to 58.4 per cent., a poor showing for four years' progress. Sir Philip Dawson has stated on several occasions recently that if all our coal mines used electricity to the same extent as the German mines do, their total consumption would equal the present sales of electricity for the whole country; under those conditions the output of coal would be enormously increased and the unit cost of production reduced, with corresponding benefit to all concerned—particularly to such industries as iron and steel manufacture, which use large quantities of coal and coke. Like the electrification of our railways, the adoption of electric power by the collieries would go far towards cheapening electricity and extending its use throughout the whole community, and now that coal-mining is once more a "going concern," we hope that a progressive spirit will animate the managers and lead them to adopt modern methods to the utmost possible extent—though the insane policy which initiated and prolonged the recent stoppage was the reverse of encouraging to the flow of capital into the industry. The Scottish mines are almost wholly electrical.

It is pleasing to observe that in 1925 there were only three deaths due to electric shock below ground, the lowest number since 1921, though the horse-power of motors installed below ground has increased by 30 per cent. since that year, and that there were in all only eight fatal accidents attributable to the use of electricity—though unfortunately one of these resulted in five deaths, due to an ignition of firedamp; eight other deaths were due to electric shock, making a total of 13 deaths during the year. Nearly 20 per cent. of the output of coal was got by machines in 1925, and the percentage of electrical machines in use increased to 70.1, but this improvement was mainly due to a reduction in the number of compressed-air machines, the increase in the number of electrical machines being far less than the former. The proportion of tonnage cut by electricity increased to 62.1 per cent. of the total cut by machines.

Wattmeter Calculations.

The Correction of Power Loss Errors.

By MARCUS G. SCROGGIE, B.Sc.

WHICHEVER way a wattmeter is connected between the supply and load there is an error, due either to the current taken by the volt coil or to the volt-drop in the current coil, which causes the reading to be too high. This error may well be neglected in the case of large power measurements, but there are many applications in which loads of the order of 100 W and less are to be measured, where the error may be very serious, particularly with low power factors. It is desirable, therefore, to find a simple way of allowing for the error without adding unduly to the work involved in taking an extensive series of readings.

In order to investigate quite generally the amount of this error, certain symbols will be used throughout, as follow :—

R_L = effective resistance of load to current at given frequency.
R_V = effective resistance of volt coil to current at given frequency.
R_C = effective resistance of current coil to current at given frequency.
V_L = voltage across load.
V_V = voltage across volt coil.
V_C = voltage across current coil.
I_L = current in load.
I_V = current in volt coil.
I_C = current in current coil.
E = proportional error = error in watts/true reading.
W = true watts in load.
W_1 = wattmeter reading, volt coil straight across load.
W_2 = wattmeter reading, volt coil straight across supply.

(1) *Volt Coil Connected Across Load.*—The circuit in fig. 1, and the vector diagram in fig. 2, show the relations between the above quantities.

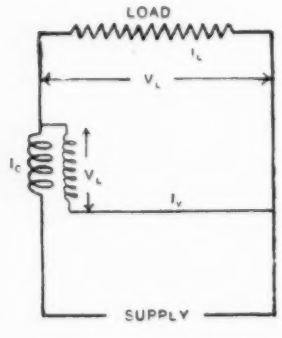

Fig. 1.

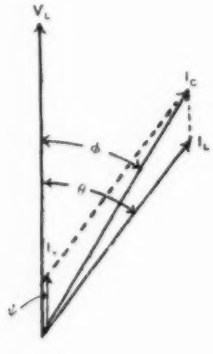

Fig. 2.

$$E = (V_L I_C \cos\phi - V_L I_L \cos\theta)/V_L I_L \cos\theta$$
$$= I_C \cos\phi / I_L \cos\theta - 1.$$
$$= (I_L \cos\theta + I_V \cos\psi)/I_L \cos\theta - 1$$
$$= I_V \cos\psi / I_L \cos\theta.$$
$$= R_L/R_V = \text{resistance of load / resistance of volt coil.}$$

(2) *Volt Coil Connected Across Supply.*—(See figs. 3 and 4).

$$E = (V_C I_L \cos\phi - V_L I_L \cos\theta)/V_L I_L \cos\theta$$
$$= V_C \cos\phi / V_L \cos\theta - 1.$$
$$= (V_L \cos\theta + V_C \cos\psi)/V_L \cos\theta - 1$$
$$= V_C \cos\psi / V_L \cos\theta.$$
$$= R_C / R_L = \text{resistance of current coil / resistance of load.}$$

It will be noticed that for one value of R_L the errors, and therefore the readings, are the same in both cases.

For, if $R_L / R_V = R_C / R_L$, then $R_L = \sqrt{R_V R_C}$,
and $E = \sqrt{R_C / R_V}$.

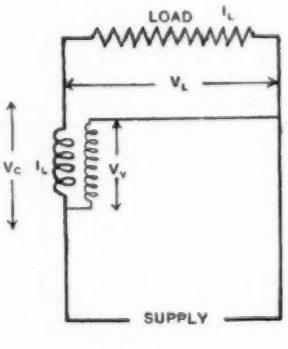

Fig. 3.

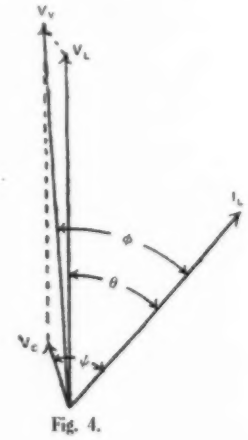

Fig. 4.

Thus if R_L is less than $\sqrt{R_V R_C}$, method 1 will give the lower and therefore the more accurate reading, and *vice versa*. If the lower reading is always selected, the maximum error is $\sqrt{R_C / R_V}$, and as this is a constant of the instrument, it is easy to ascertain before proceeding further whether this amount is large enough to warrant making the correction. For example, if the current coil has a resistance of 0.25 ohm., and the volt coil 10,000 ohms, the maximum error is 0·005, or ½ %, which for most commercial work would be negligible.

Plotting E against R_L we get a curve as in fig. 5. It is not convenient to read off the error from this type of diagram as R_L will not generally be known. But another curve may be derived from this one by plotting the error of the lower reading against the ratio between the two readings. It should be noted that it does not matter which reading is the greater; the error will be the same for a given ratio as long as the ratio is always expressed as a number either greater or less than one, but a better curve is obtained if the latter course is adopted. This will now be proved and at the same time a formula derived for plotting an error curve without having to derive it from fig. 5.

(1) W_2 *greater than* W_1.

Then $E = R_L / R_V$ and $R_L = ER_V$,
$$W_1 / W_2 = (1 + R_L / R_V) / (1 + R_C / R_L)$$
$$= ER_V (1+E) / (ER_V + R_C).$$

(2) W_1 *greater than* W_2.

Then $E = R_C / R_L$ and $R_L = R_C / E$,
$$W_2 / W_1 = (1 + R_C / R_L) / (1 + R_L / R_V)$$
$$= ER_V (1 + E) / (ER_V + R_C).$$

Thus the same result is obtained in both cases. A curve can be plotted of E against W_1 / W_2 or W_2 / W_1, as the case may be, from the above. A formula giving E explicitly in terms of W_1 / W_2 is too cumbersome, but there is no difficulty in obtaining the graph from the inverse expression above.

Most commercial wattmeters have several ranges, so that a separate curve is required for each. They are of the shape indicated in fig. 6.

In some work it may be considered more convenient to have some means of calculating the correction instead of having to construct a chart. The exact expression giving the true reading in terms of either of the observed readings is rather cumbrous, and involves a small difference between two very large quantities; it is therefore totally unsuited or practical work. The following method gives a very useful approximation, W_1' and W_2' being the corrected readings from W_1 and W_2 respectively.

As the lower observed reading, say W_0, will be a rough

approximation to W, it will give a sufficiently accurate correction to assume that

$$R_L = V_L^2 / W_O.$$

Now $W_1/W = R_L/R_V + 1$,

$$W = W_1/(R_L/R_V + 1),$$

$$W_1^1 = W_1/(V_L^2/W_O R_V + 1),$$

and $W_2/W = R_C/R_L + 1$,

$$W_2^1 = W_2/(R_C W_O/V_L^2 + 1).$$

These are not the most elegant forms in which to express W_1^1 and W_2^1, but they are the most convenient for calculation. Either of these gives a very good approximation to the true watts, so only one reading need be taken so long as it is known to be the lower one: but it is better to take both and average the corrected results.

This subject has been treated quite generally, as regards

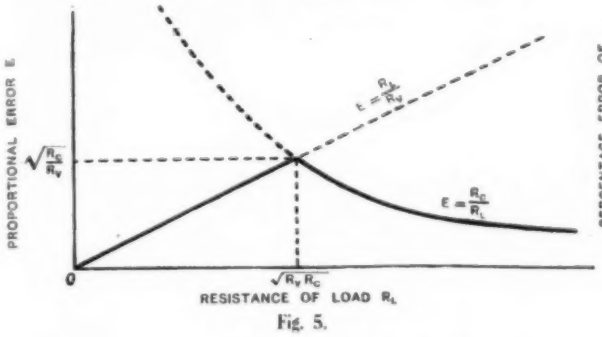

Fig. 5.

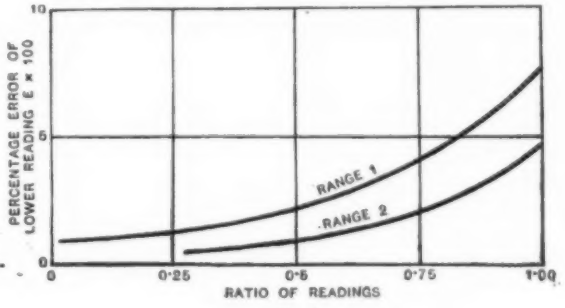

Fig. 6.

single-phase work at least, so the results apply to all phase angles, leading and lagging, and also to d.c. measurements with an ammeter and voltmeter. In order to check the above work, extensive measurements were taken with various loads, power factors and ranges, on an Elliott portable precision-type instrument reading to 44W on the highest range, and both graphical and calculated corrections were extremely satisfactory. The maximum possible error of the lower reading, using the range most subject to error, was 12·2 %, but some of those corrected on the higher reading were over 50 %.

The procedure in making graphical corrections is briefly summarised thus:—

(1) Find the resistances of the volt and current coils of each range of the instruments. The maker usually supplies these particulars, but they may be measured in any of the usual ways.

(2) For each range plot a curve of lower reading/greater reading against percentage error from the formula

lower reading/greater reading $= E R_V (1 + E)/(E R_V + R_C)$

(Percentage error $= E \times 100$).

(3) When using the instrument arrange a flying lead or switch from one end of the volt coil to either end of the current coil alternately, thus giving two readings.

(4) Divide the lower reading by the greater, read the percentage error off the chart, and reduce the lower reading by this amount, giving the correct result.

Automatic Contactors for A.C. Motors.

A Review of Modern Methods of Control—The Functioning of Such Apparatus.

By G. WINDRED.

THE automatic operation and control of a.c. machinery forms a subject of rapidly increasing importance in view of the modern requirements, and it is the object of the present article to review the various modern methods of a.c. motor control in a manner intended to remove some of the difficulties which appear to exist regarding the functioning of such apparatus.

The method of procedure in the present article will be generally similar to that adopted in the writer's previous article on d.c. gear,* and, owing to the extensive nature of the subject, the same limitations regarding scope of treatment apply in this case; hence only the most outstanding points of the subject can be discussed.

In the first place, it is obvious that the use of a.c. for operating contactor switches necessitates a totally different construction from the d.c. type, since it now becomes necessary to provide a laminated magnetic circuit. For quiet and efficient operation, it is necessary that the construction be mechanically good, and that the contact faces of both core and armature be uniform and bear evenly upon each other when the switch closes.

The general arrangement of the magnetic circuit of an a.c. contactor is as shown in fig. 1. From this figure it will be seen that unless special arrangements are provided, the closing of the contactor from a supply circuit of ordinary frequency will result in the armature A chattering, owing to its tendency to leave the core when the flux produced by this member passes through its zero points in the a.c. wave. This tendency is eliminated in practice by the provision of a "shading coil," arranged as shown at S in fig. 1, enclosing approximately two-thirds of the pole area. The effect of the shading coil is to delay the passage of the magnetic flux over the portion of the pole area which it embraces, this, of course, resulting in a more constant pull from the core member.

Owing to the reactance of the operating coils of a.c. contactors, it is generally unnecessary to provide economy resistances as in the d.c. case for high voltages, and also the application of cut-in resistances for interlocking purposes is not possible with a.c.

Fully automatic a.c. controllers almost invariably operate on the time-limit acceleration principle, the timing relay in this case taking the form of a shunt-wound solenoid, the plunger of which operates a mechanism which is delayed in action by an oil dashpot and makes contact consecutively to the accelerating contactor-coil circuits. The time required for the acceleration of the motor is then variable by adjustment of the oil dashpot.

A complete line diagram of connections for an automatic a.c. equipment operating as described above is shown in fig. 2. In this diagram M, 1R, 2R, 3R represent d.p. contactors, while TR is a timing relay, the contact arm of which has a delayed action while travelling downwards. The sequence of operations is as follows:—

Upon the "start" button being pressed, the operating coil of timing relay TR becomes energised, and its contact bar is immediately drawn upwards, energising

* ELECTRICAL REVIEW, November 19th, 1926.

coil M of the main contactor and thereby connecting the motor to the line with all the rotor resistance in circuit. The energising of contactor M results in the closing of the normally open interlock, thus maintaining the coil circuit of M. At the same time the normally-closed interlock opens, disconnecting the timing relay coil, and TR now falls under the action of gravity at a rate controlled by the adjustment of an oil dashpot, energising the accelerating rotor contactors in the correct sequence as it falls. When the final accelerator closes, a normally-closed contact which it carries opens, de-energising the intermediate contactors. Pressure on

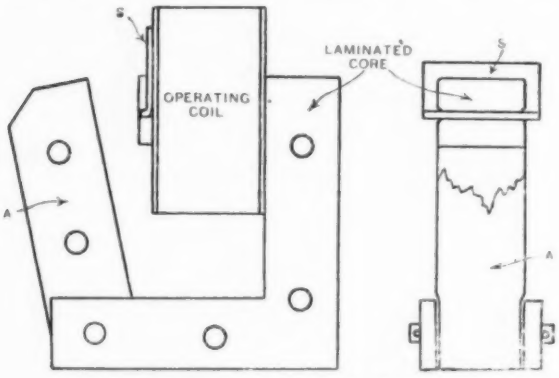

Fig. 1.—Magnetic Circuit of A.C. Contactor.

the "stop" button disconnects M and 3R from the line, thereby stopping the motor.

In the case of squirrel-cage motors of appreciable size, a primary-resistance starter is often employed, the connections in this case being similar to those described above, with the exception that the accelerating contactors would be arranged to cut resistance out of the stator circuit. The starting of induction motors by the primary-resistance method should, however, be avoided as much as possible, as it results in a very low starting torque efficiency.*

Star-delta or auto-transformer starting is much to be preferred, and for this reason it is proposed to describe these methods arranged for automatic operation.

A line diagram of connections suitable for operating

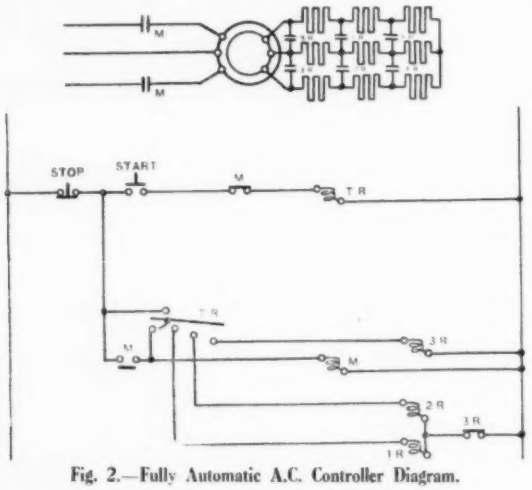

Fig. 2.—Fully Automatic A.C. Controller Diagram.

an induction motor on the star-delta principle is shown in fig. 3. Referring to this diagram, pressure on the "start" button results in the closing of contactor S, whose interlock contacts thereupon operate to close the main contactor M. The three phases of the motor are now arranged in star connection across the lines, and will remain so as long as the "start" button contacts are kept closed. Upon releasing the "start" button, contactor S opens, but M is still maintained through its own interlock contacts. The S interlock now occupies its normally-closed position, and contactor D is energised through this contact. This operation results in the full line voltage being connected across each motor phase, the connections of the motor now being in delta. It will be seen from the diagram that contactor S must be open before D can be closed. Unless this interlock is provided, failure of contactor S to open when de-energised prior to the closing of D would result in a complete short-circuit of all three phases when D operated.

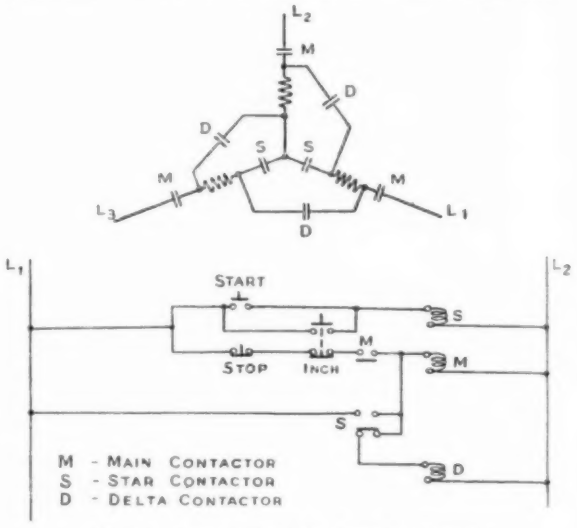

Fig. 3.—Automatic Star-Delta Operating Diagram.

"Inching" may be obtained, as shown in the diagram, by means of a double-contact push-button which closes S and opens the maintaining circuit of M, so that when the button is released S and M open.

For automatic auto-transformer starting, the connections may be very similar to those described above so far as the control circuit is concerned, and the arrangement of connections for this method of starting is probably sufficiently well known to render further description unnecessary.

A.C. Drum Controllers.

For the starting and speed regulation of large slip-ring induction motors and for heavy duty generally, it is usual to employ an a.c. drum type controller working in conjunction with a contactor panel, the contacts

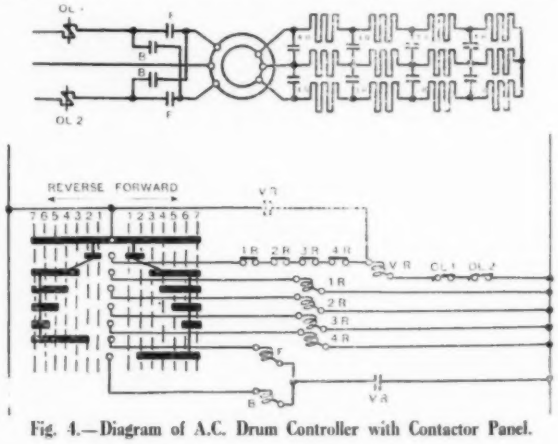

Fig. 4.—Diagram of A.C. Drum Controller with Contactor Panel.

of the control drum being arranged to handle the appropriate contactor circuits on the panel.

The line diagram, fig. 4, is typical of the principle upon which a full-reverse multi-speed a.c. controller operates, the sequence of operation being as follows:—Upon moving the control drum to the first "forward" position, a circuit is made for relay VR, provided that the normally closed interlocks on contactors 1R, 2R, 3R and 4R are open, *i.e.*, that all rotor resistance is in circuit. The closing of VR allows contactor F to be energised when the drum is moved to No. 2 "forward" position. On the closing of F, the motor is connected

* See the author's article, "Polyphase Induction Motors," *Electrician*, February 15th, 1924.

to the line with all the rotor resistance in circuit, this being the first speed step. On step No. 3, contactor 1R is operated, short-circuiting one step of the rotor resistance, and relay VR now maintains its circuit through its own contact shown on the left-hand side of the diagram. Subsequent steps of the drum controller now effect the short-circuiting of the rotor resistance by means of the accelerating contactors 2R, 3R and 4R, the motor being then accelerated to full speed. If the controller is moved from the full-speed position, the accelerating contactors will be de-energised in the order 4R, 3R, 2R, &c., and the motor slowed down. By this means speed control is obtained.

For reverse running and speed control, a similar set of operations is gone through, but in this case contactor R, which handles the reversing connections for the motor, is energised.

The overload relays, shown on the diagram at OL1 and OL2, protect the motor from excessive currents by opening the contactor VR circuit, after which it becomes necessary to return the drum controller completely to the "off" position in order that the accelerators 1R, 2R, 3R, 4R may fall out and complete VR coil circuit.

In the case of failure of voltage, relay VR will open along with the other contactors, and upon resumption of the supply it will be necessary to return the controller to the "off" position, since no circuit exists for VR until this is done. This feature prevents damage to the motor due to a resumption of the line voltage after having been cut off with the drum controller in the full-speed position.

The Braking of A.C. Motors.

In the general case of a.c. motors, it is, of course, impossible to apply the principles of divertor control or dynamic braking as is possible with d.c. machines, and for this reason the braking of a.c. motors forms a rather difficult proposition. It is in general only possible to use a shunt-wound brake, which may have its winding arranged to suit the supply circuit, single, two, or three-phase, and may be energised, *i.e.*, released upon the closing of the stator contactor.

Conclusion.

The foregoing general treatment, although very brief, will be found to cover the chief points of interest or importance in connection with the control of a.c. motors; any further investigation of the subjects mentioned would necessitate a certain degree of specialisation, which, however, the writer has attempted to avoid in this instance.

Colliery Power Stations.

A Modern Yorkshire Plant.

By C. H. S. TUPHOLME.

A POWER plant of appreciable size that runs continually under what amounts to daily test conditions is something out of the ordinary, and yet such is the case in the power station recently put into operation at one of the largest collieries, at Frickley, near Barnsley. This plant not only generates sufficient power for the needs of the various pits of the company to which it belongs, but it also supplies several other collieries in the neighbourhood, as well as four mining villages, at rates so low that no statutory power company could hope to compete with it.

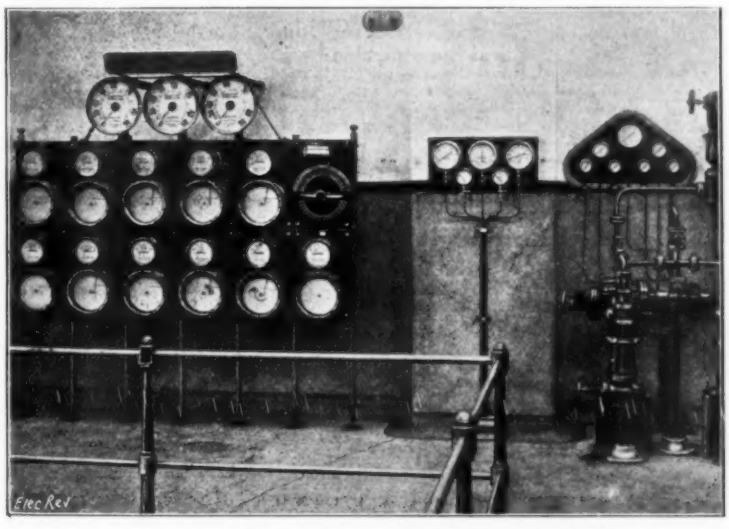

Fig. 1.—Recording and Integrating Instruments.

The installation is remarkable in that all the raw material employed in the generation of the electricity is indicated, recorded and integrated, and the engineers-in-charge can, by studying a group of dials assembled together on a board, tell exactly what is happening at every stage of the power generation, while the fact that all the functions of the plant are integrated means that the most accurate guide as to the cost of the generating per unit is afforded.

All the coal burned is weighed automatically, while the water evaporated by the boilers, the steam passed to the turbines and to the auxiliaries, and the condensate and make-up are all recorded, indicated and integrated on a series of dials mounted on a large panel in the turbo room, fig. 1.

The method employed for these recording instruments is known as the "Electroflo" principle, by which means any function in any part of the plant may be measured and indicated on a dial situated in any convenient position, so that an engineer can, without moving from his office, read on dials conveniently placed exactly what is going on in the works under his charge.

The equipment of the station represents the most up-to-date of British power-station plant. Four Babcock & Wilcox triple-drum boilers are used, each evaporating 40,000 lb. of steam per hour at a working pressure of 275 lb. per sq. in. They are served by automatic

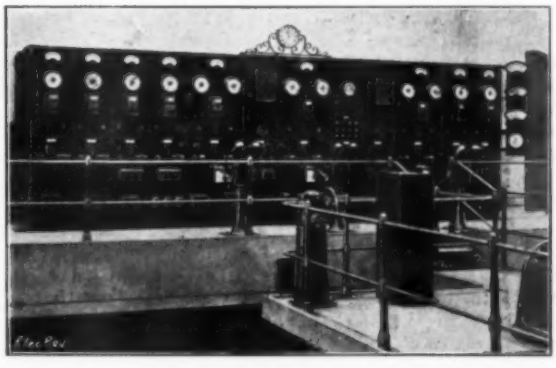

Fig. 2.—Main Switchboard.

chain-grate stokers, each grate being driven by an epicyclic gear. The power is generated by three B.T.-H.-Curtis turbo-alternators, fig. 3, of 7,500 kVA, 0.8 power factor. Fig. 2 is a general view of the main switchboard at the power station.

The current is distributed overhead on the ring-main principle at 22,000 V. It is supplied to the four mining villages for lighting at a flat rate of 1s. 3d. per week in the summer and 1s. 6d. per week in the winter, the wiring being carried out gratis by the colliery company, and including the switches, ceiling roses, flexible cords, lamp-holders, lamps and shades, though the replacement costs must be borne by the tenant. The "limiter" system is employed, and provides for a maximum supply to each consumer of 180 watts. Should the load exceed this limit, an automatic limiter causes all the lights to flicker up and down until the excess light is switched off.

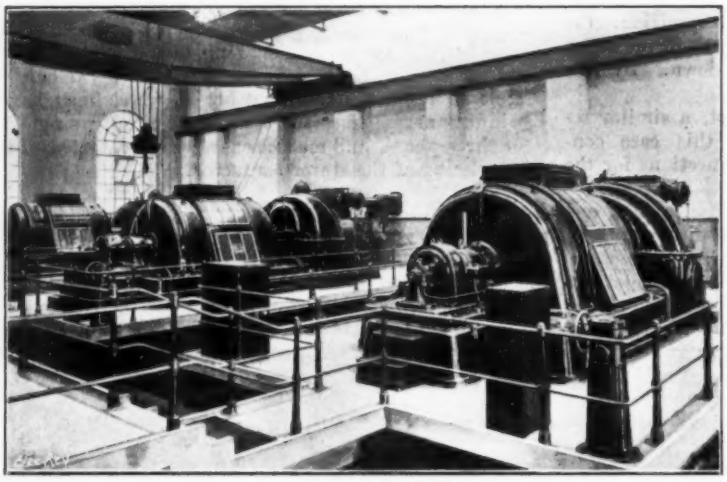

Fig. 3.—7,500 kVA Turbo-alternators.

Where the current is used for both lighting and heating or power, a meter is installed at a rental of 1s. per week, and 1.125d. is charged for each kWh consumed.

The colliery also supplies churches, hotels and shops in the neighbourhood at 4d. per kWh up to 600 kWh per annum, 3d. for every kWh over 600 and under 900, and 2d. for each kWh above 900. The charge for small power users is 2d. per kWh up to 2,000 kWh and 1½d. for every additional kWh within one year. Special rates are contracted for in the case of large power users. In spite of these charges, a small profit is obtained—enough to clear the expenses.

A study of this power plant leads one to speculate as to what economies might be effected by generating electricity for public supplies at the pit head, where fuel is "on the doorstep," at an extremely low cost, provided, of course, that the station were planned and equipped on the same modern lines as the one mentioned in this article.

The Trials of a Housewife due to Trials of Electricity.

By MAY M. CRAMP.

LET me begin with the statement that I am one of those housewives who are invariably on the look-out for labour-saving devices. For this reason I am always wishing for more electrical appliances, since their cleanliness and portability are beyond question, but I am continually faced with a number of difficulties, partly technical and partly commercial. No doubt some, certainly not all, of the former would disappear if I were a trained electrical engineer; but it is too much to expect every married woman to be thus qualified.

To begin at the point where the cables enter the house, my first trouble is with the meters. The dials are sufficiently small and difficult to read in any case; but to make matters worse, the meters are nearly always in dark and inaccessible places. To take my readings, I have to employ a match, the old-fashioned candle and a pair of steps!

My next quarrel is with the fuseboard. This, like the meter, requires the services of a pair of steps. The wiring contractor never troubled to mark the fuses with the names of the circuits which they control, thus necessitating much loss of time in research work. The fuse carriers themselves (of the Home Office pattern) are provided with small and inaccessible screws, which make the contact with the fuse wire always questionable—and their manipulation is a tax upon my self-control.

As regards the circuit wiring, I have had serious troubles. The first was the constant breakdown of the wires in the cellar, caused by the condensation of moisture in the steel tubes. This has happened in the only two electrically-equipped houses in which I have lived, and no cure was forthcoming until the whole of the cellar tubing had been removed and the wires replaced by cab-tire flexible. Notwithstanding the frequency of this occurrence, I understand that the same old faulty system is still being provided for other poor housewives.

My second trouble with the circuit wiring led to a serious outbreak of fire in the nursery floor. In this case the steel tube had been laid in contact with a lead pipe supplying a gas stove. The earthing of the tubing was evidently faulty, so that when a leakage occurred a spark passed between the electric tube and the gas pipe which melted the latter, setting fire to the gas, and giving me a pyrotechnic display, which burnt the floor. This happened when I had just gone out, leaving the house empty. Had I not turned back for something and discovered the fire, the house would probably have been burnt to the ground. As it was, I immediately ran to the gas meter and cut off the gas.

Though my experience cannot be unique, I have seen houses quite recently in which the wiring was being laid in this very same dangerous manner.

Coming now to the fittings, I have had the usual troubles with flimsy switches and faulty lamp-holders, but these have not caused me much anxiety. What I have worried about is the breakdown of the flexible at the point where it enters the laundry iron. On more than one occasion a short circuit has taken place at this point, which has frightened and sometimes burnt the operator. The iron has been dropped by the startled ironer and damaged. I have yet to see a flexible joint which I should consider satisfactory for this purpose.

On one occasion the heating unit of my iron burnt out, and I returned it to the makers to be repaired; but it was *six weeks* before it was sent back to me.

During the recent coal strike, I made much use of my electrical radiators. One is a four-lamp radiator. One lamp broke, and the makers tell me that they are not making any more of that pattern, nor any lamps that will replace mine! Another was a circular radiator with a wire spiral element. This burnt out, and I took it to a local firm for a new element. It was *a month* before the new element was obtained, and the firm sent it back, not fitted in, but loose with the radiator. After taking out fourteen screws, I removed the old element, only to find that the new one was ¼ in. too large in diameter to go into the recess provided for it—so I must now begin again!

While commenting upon radiators, I should like to add that however attractive these may look when new, they soon get an appearance of "shabby finery," which makes me dislike to see them about. This is due to poor design in the aesthetic sense.

In general, my criticism of electrical fittings is that they are not robust enough to withstand ordinary household usage, and although they save labour in one direction, they entail much time in repairs. At present the time and energy of the unskilled labourer (*i.e.*, the charwoman or cook) are saved at the expense of the time and labour of the housewife—if she has intelligence and mechanical sense; if not, then her husband's more valuable leisure is encroached upon.

Turning now to the commercial aspect, I should like to have electric cooking and an electric heater for water such as are used in Switzerland; but before I invest in the former, I must pay about £30 to have a larger cable brought into the house; and no tariff is provided in my district which would enable me to afford a water heater. I have never been charged for the laying of a gas supply.

Again, it is easy to acquire gas apparatus at a very reasonable price and on the hire system; but although the electrical authorities are beginning to supply apparatus on easy terms, the prices are higher than for the corresponding articles using gas or oil.

Once again, I wish it to be clearly understood that I am heartily in favour of an all-electric house, but I do not think that this desirable consummation is likely to be reached until some of the troubles to which I have referred are eliminated.

The first step towards removing these difficulties is to make them known to those who are responsible for the arrangement of electrical installations. I do not think manufacturers and contractors realise the trials to which we are subjected by avoidable mistakes. Perhaps one of the best solutions would be the employment of more women in connection with the design and installation of domestic electric apparatus; but failing this, publicity by women must be adopted for the realisation of our hopes.

I think most women find that an electrical installation is a sort of dark horse. With gas, if anything is wrong we can smell it, and we know that the gas must be turned off at the meter and no lights shown. Would that electricity could give us some such warning!

The majority of women have concrete minds, and the intangibility of electricity is the basis of their mistrust in it.

Rail Charges and the Electrical Industry.

Acquaintance with the Rates saves Money.

By J. W. PARKER, A.M.Inst.T.

In these days of alternative means of transport for nearly every variety of goods it is necessary to study closely comparative transit costs if economical haulage and reduced carriage charges are to be secured. Road transport charges are straightforward but railway goods quotations are more or less complicated; hence to ensure an accurate comparison in all cases, some knowledge of the principles of goods rates and classification is necessary. The latter really fixes the rates by determining in which of eight different classes any particular goods shall be placed. The classification is contained in an official railway publication costing 1s., which is based upon a statutory list authorised under the Railway and Canal Traffic Act, 1888.

The eight divisions mentioned are A, B, and C, and 1, 2, 3, 4 and 5. Goods of low value are in "A," Class "5" being reserved for the most precious merchandise. Sand, coal and similar minerals are found in "A," lime and pig iron in "B," and nuts and bolts, rough forgings and telegraph posts in "C." In the numbered sections, earthenware insulators, screw jacks, accumulator plates and zinc rods are covered by "1"; electric cable, motor controllers, generator parts and transformers by "2"; cable winding machines, fuse boxes and switchgear are in "3"; electric lamps, switches and heaters in "4"; while in "5" come electroliers and various kinds of glassware. Minimum wagon loads are in force for the lettered divisions to the extent of 4 tons per truck for A and B, and 2 tons for C. "A" class traffic is usually conveyed at rates which do not include the provision of trucks, whilst neither "A" nor "B" covers the services of loading, unloading and covering. "C" has the benefit of all these services, but not of collection and delivery as is usual in the numbered sections.

Classification being the basis of almost all rates, any error at this point shows itself in the subsequent charge, thus if goods are not correctly described on the consignment note, loss may result, as the same articles often figure in more than one class, and the railway can hardly be blamed for applying the higher rate. The following is a case in point:—

Generators in cases—class 2.
Generators otherwise—class 3.

The simplest method of ascertaining the various rates is to ask the railway to supply details, but the most direct is to take advantage of Section 14 of the Regulation of Railways Act, 1874, which enacts in respect of station rate books:—"Every such book shall, during all reasonable hours, be open to the inspection of any person without the payment of any fee." By exercising the right of rate-book inspection it is possible not only to obtain details of class rates, but from time to time to obtain particulars of exceptional rates as they come into use. The latter charges, as is well known, are lower figures granted for large lots, to meet competition and for other reasons. On no account can they be neglected, and as new figures are always being put into use, the need for being up-to-date in this respect need not be laboured. It may be that a firm has not got exceptional quotations, although the volume of its traffic is sufficient to justify them. In such instances the railway should be approached, full details of the traffic being furnished in support of the request.

At present, goods charges stand some 50 per cent. above the pre-war level, and as most of the rates in the railway books are pre-war figures, the addition of this percentage is necessary to bring them up to date.

Consignments not exceeding 3 cwt. have the usual rates increased by a bonus sum in recognition of their being relatively costlier to handle than larger lots. This bonus and the 50 per cent. increase are embodied

in the "smalls" scale of the classification, a method which avoids the necessity for any calculation in arriving at the amount of carriage due, as the charge can be seen by a glance at the scale. Where a firm has a number of "smalls" for one town it can economise by bulking them for the rail journey in instances where the total weight exceeds 3 cwt., the following being an illustration:—

Pre-war rate, *i.e.*, to-day's "smalls" rate – 35s. 6d. per ton.

Up-to-date, or tonnage, rate, 35s. 6d. + 50 per cent. + 6d. flat rate = 53s. 9d.

Weight of parcels.			Charged at 35s. 6d. on "smalls" scale.			Charged together at tonnage rate, 53s. 9d.	
Cwt.	qr.	lb.	s.	d.		s.	d.
0	3	0	2	11			
1	0	14	3	11			
1	0	0	3	8			
0	1	0	1	6			
0	2	0	2	3		10	9
0	1	14	1	9	6 split del. charges at 3d.	1	6
4	0	0	16	0		12	3

From this it is seen that a saving of 3s. 9d. is effected by "bulking" the six parcels. The charge of 3d. per consignment is for the service of split delivery at the destination.

A number of appliances and machines are accepted for conveyance at a reduced rate when consigned at owner's risk, and these are distinguished in the classification by the letters X, Y, or Z, following the class number. X is equal to a reduction of 10 per cent., Y to 15 per cent., and Z to 20 per cent. from the appropriate class rate, thus whereas the full class 4 rate is 61s. 8d. per ton, electric heaters in 4 Y would only be charged at 49s. 2d.

Other articles will not be conveyed at company's risk unless adequately packed, but packing may be unduly expensive or heavy, and it has to be paid for at the same rate as the goods it covers, so it may be cheaper to partially protect the contents and consign at owner's risk. Many firms find it profitable to take this course. Some of the goods affected by this rule are electric fires and stoves, switchboards, electroliers, ammeters, voltmeters, radiators and insulators.

In the ordinary way a large number of objects sent in small quantities cannot qualify for exceptional rates, and to meet this position, "list" rates have been introduced wherein as many as 250 distinct articles are grouped together under the generic terms of hardware, machinery, iron and steel, &c. The machinery list, for instance, comprises amongst others, coal-conveyor parts, electric cable winding machines, field pieces (unfinished), generators, magnets and transformers.

The Railway Rates Tribunal having been occupied in fixing new rates, settling fresh conditions of carriage, and generally investigating the relations of the railways and traders for the past six years, is now bringing its work to a close. The new rates, &c., will before long be in force to cause dislocation and confusion in all places where the impending changes have not been studied in advance. An acquaintance with the new state of affairs made now will thus be of great value.

The Traveller's Connection.

To Whom Does It Belong?

(COMMUNICATED.)

A PERUSAL of the "Situations Vacant" column of any paper will show that on the selling side of a modern business a representative, traveller, or salesman is almost invariably required to possess a connection. The practice raises the interesting question: Who is supposed to own the customer; the salesman, or the house employing him? The regularity of the demand on the part of so many different makers seems to point to a general belief on their part that the proprietary interest in the customer (in other words, the connection) resides in the salesman, but one may also encounter cases where the contrary opinion is very strongly expressed upon occasion.

What is a Connection.

The writer, as a result of extended observation of selling results in such circumstances, is tempted to express the opinion that the "connection" for which so much is claimed, and of which so much is expected, is largely an illusion. As it is usually understood, the expression is taken to imply that there is in existence a body of buyers needing a certain article who will only buy if it is offered to them by a certain representative, and that, thanks to the friendship and regard which they have for this representative, they will buy whatever make he happens to be handling. If this meaning, which is consciously or sub-consciously attached to the expression is only defined in words, its improbability is clearly perceived. If the meaning is reduced to a more likely basis, it merely implies that the salesman knows the names of, and occasionally has a nodding acquaintance with, a number of buyers of a certain class of goods. By reason of his service with one manufacturer, he will also know the prices at which they have been in the habit of buying that particular make; but by taking his services and his knowledge to another manufacturer it by no means follows that these buyers, or any considerable number of them, will automatically commence to buy a different, competing, article, probably at a different price! When the basis of a connection is stated more reasonably, its importance begins to diminish considerably. A knowledge of buyers' names and addresses in the vast majority of cases is seldom or never a trade secret. There are few trades in existence where it would not be possible for an intelligent worker without previous experience to compile a list of the majority of the important buyers after a week or two's intensive study of directories and other sources of information. Naturally, however, when it comes to making personal calls upon any large number of such customers, the salesman who has called upon them before would have some advantage over a stranger in the case of the first journey, on account of the greater speed with which he could get about, and sometimes in a greater ease in getting into touch forthwith with the right man; but whether these points have the importance which is usually attached to them is open to question.

The knowledge of names and addresses being information which can usually be obtained from directories, and the advantage of a nodding acquaintance with a buyer, once made, being obviously inseparable from the salesman's personality, we may consider that in the majority of cases the "connection" (for what it is worth when considered on commonsense lines), if it does not actually belong to the salesman, is at least a kind of knowledge or advantage which cannot either be taken from him or discarded.

Other Cases.

There are, however, certain exceptional cases which do not fall so readily into the above category. Some classes of *clientèle* have been got together by dint of continuous and expensive advertising, and the buyers may not be traced in directories in the same way. A typical case would be some mail-order business whose clients are obtained from all classes in a community, irrespective of their actual trade. Obviously this knowledge belongs

absolutely and exclusively to the house at whose expense it was obtained, and not only would any attempt to carry the information to a competitor be highly improper and dishonest, but it would be a proceeding against which the courts would provide a very effective remedy.

There is other business in which it would be improper for a salesman to intervene on behalf of another maker. In certain branches of the engineering and heavy electrical industry, there is no circle of regular buyers, but merely isolated and chance transactions from varying classes of the community. Negotiations for a new motive-power plant, for instance, might in certain cases be spread over twelve months or even a longer period before the business was finally concluded. An outstanding case of this sort which was known to a salesman from his connection with a previous employer should obviously be left alone until the particular outstanding quotation was decided. Even in such an instance, though the make of plant which is finally selected will generally depend upon its own merits and price, it is seldom that the mere fact of a member of a manufacturer's staff transferring his services to a rival business has such a disastrous effect as is commonly feared!

Exports.

Another interesting example which lies on the border-line is that furnished by an undertaking where an executive may have developed a fresh line of trade entirely through his own initiative and knowledge. Most readers will be readily able to recall such cases where it would be extremely difficult to apportion exactly what share belonged to the house and what to the employé. In one case where a certain field of foreign trade had been worked up by a sales manager for the firm by whom he was employed, the writer found that the executive in question was disposed to claim almost a proprietory interest in the trade. According to the argument set up, this particular executive was prepared to show that he had been regularly refused the slightest expenditure in this field of work, that not a single one of the buyers had been previously known to anyone in the organisation, and that all the business had been obtained in the face of indifference practically amounting to opposition. In this exceptional case, as the knowledge of the importers and buyers in question had been brought by him, he claimed that in the event of any transfer of services he would be entitled—short of actually interfering with definitely-concluded business—to utilise his knowledge or "connection" in any other business he might wish, whether competitive or otherwise.

Ethics of the Question.

A more careful consideration of the whole question will probably lead to the conclusion that the "connection," in the meaning which is usually attached to the word, seldom exists in actual fact, and the mere knowledge of regular buyers, which is really all that is implied by the word, is in the majority of cases legitimately part of the salesman's stock-in-trade or equipment, or, at all events, it is not easily separated from him. A salesman who has a slight degree of acquaintance with an individual buyer cannot obviously meet him as a stranger simply because he has changed his employment. The value of the acquaintance, however, is usually very much less than is usually believed, and in this respect the exponents of the modern art of salesmanship are undoubtedly right in stressing the importance of service and salesmanship rather than the claim to a more or less shadowy connection.

That there are border-line cases, and that there are other cases where the knowledge of a previous business should not be used in any way by a salesman, cannot be disputed, and in view of the importance of the question raised by such cases it would undoubtedly be useful if the ethics of the subject were ventilated by discussion by some association composed of sales executives, and a working code of procedure were arrived at. The majority of salesmen, no less than the majority of employers, are probably animated by the desire to act fairly, but for lack of any generally-accepted procedure there is occasionally apt to be a strong difference of opinion as to what experience belongs to the undertaking and what to the employé.

Co-ordinating Research and Industry.

The Need for a "Middleman" of Science.

By W. R. NEEDHAM.

THE best teacher is not always the cleverest teacher—in point of fact, he is seldom an exceptionally brilliant scholar. His excellence resides otherwhere. He is able to interpret; more, he succeeds in interesting his pupils, and, most important of all, he provokes them to useful effort. His scholars become students in the real sense of the term. He acts the part, fulfils the *rôle*, of *liaison* officer between specialist and novice. Similarly, it is the exception rather than the rule when the expert in pure scientific research unites in his one person scientific attainment and commercial, industrial application thereof. Usually, the worker in pure science makes his important—sometimes immeasurably important—discoveries, and it is left to the more or less chance discernment of the man of affairs ere such potential wealth be brought to the surface and usefully employed. The data available are numerous and valuable. Great as are the uses to which much of our hardly-won knowledge has been put, there is still between the possible and the actual a great gulf intervening. Fortunately, it is not an impassable gulf. It is a chasm whose span can be contracted, not *ad libitum*, but very considerably, at will. That relatively so little has been done to exploit commercially these potentialities is not so much the fault of either scientist or manufacturer: it is almost inevitable, owing to the grievous lack of co-ordination between the two.

As things are, there is much highly-important ground already won, and the territory reclaimed is being extended. Unfortunately, those who could cultivate the land are mostly unaware of its potentialities, some of them of its very existence. Here is essentially the opportunity for the middleman of science. He need not be himself an expert—in general it is far better he should not be. He is an agent, not a principal. His job is to bring the principals together. Thus, so far as research in pure science, and the commercial and industrial applications of such research discoveries are concerned, this *liaison* officer requires to be so sufficiently master of either lore as to effectively help both parties to a common understanding of the possibilities which await and will reward their joint efforts. It is no sinecure, this task of his. Not necessarily eminent as a scientist, nor yet far famed as a captain of industry, he has in a way to do and to be more than either the one or the other. He has to know, for instance, the methods and results of pure and also of applied research, so as to be able to interpret those results and appraise their value; he has further to know the needs of certain branches of industry, and more, to understand the practical implications, in order that his recommendations shall be at once timely and practicable. Perhaps, most of all, he needs the insight and the vision which will enable him to see what is possible, where such

possibilities lie, and how to advise helpfully respecting their exploitation for practical uses.

All this requires more—much more—than natural aptitude; careful, thorough, well-informed training is also and equally necessary. Such men are born, but they must be grown likewise.

In this connection the interested reader will find matter for serious reflection in an article written for the *Manchester Guardian*, October 5th of this year, by Mr. A. P. M. Fleming. An eloquent and powerful plea is made for effective *liaison* as between pure research and industry, particularly the engineering industries. As against the normal procedure by which such graduates as undertake research do so for a period of one or two years in the university, following directly upon their ordinary engineering course there, Mr. Fleming deems it far preferable to dovetail between ordinary courses and research work first-hand practical industrial experience obtained at the fountain head. Then the investigator will return to his university primed with a knowledge, not only of what industry would welcome from him, but also of what industry's needs really are. Himself a widely-acknowledged authority, particularly as regards his association with, and direction of, electrical research, Mr. Fleming points the moral by instancing the intimate co-relationship existing between discoveries made in pure science and their practical embodiment throughout the whole range of electrical engineering theory and practice. Thus, he draws attention to the fact that wireless communication, thermionic valves, modern electrical illumination, therapeutic application, are all the outcome of investigations made and findings registered by research workers in pure science. All electrical phenomena, including the properties of magnetism and electrical conductivity, and the behaviour of dielectrics, are sub-atomic in origin; and the physical characteristics and behaviour of all materials find an explanation in the same source. Accordingly, he stresses the vital importance—considering how intimately the question of materials, their economic use and fabrication, affect every branch of the industry—of providing the necessary link between science and the industry. He specially seeks to direct attention to, stimulate interest in, those centres of research which actively investigate sub-atomic behaviour.

The skilled scientist conducts his researches usually without direct thought of anything distinctively utilitarian; they in industry have their eyes upon essentially practical issues. Many discoveries made by the worker in pure science research have proved to be of immense practical value. Men of affairs have developed them and turned them to notable industrial uses. Much more, however, might be done than is done. It only requires that someone capable of appreciating needs and understanding ways and means should be on the spot to direct the attention of those most intimately concerned to the facts of the case. Here, then, is the *rôle* of this intermediary. He can point out the way as no one else can; he can bring research and industry together; he is able, too, to direct and stimulate applied research as is not possible in any other way.

The opportunities are many; they are great. The material is available. The need should be obvious to all interested parties. It must be made obvious. It only requires that Britain takes advantage of the possibilities afforded her. Let her provide that link which shall harness science and industry into useful, active co-partnership. The results will amply justify all reasonable expectations. Those results will not follow unswervingly any particular line that industry may map out beforehand, but they will exceed in value anything conceived in so purely mechanical a manner. Industry will learn to fall into line with science in that particular also, and will thankfully accept what research and her own carefully-undertaken application of it offers. The rewards will be numerous and substantial and the results will be of great practical utility.

The Performance of Modern Broadcast Receivers.

An Account of Some of the Work of the Research Department of Burndept Wireless, Ltd.

By P. K. TURNER, A.M.I.E.E., M.I.R.E.

IT is well known among the better-class manufacturers of broadcast radio-telephone receiving apparatus that the coming of the Kone loud-speaker, with its very much extended range of frequency reproduction, has made possible a "revolution" in the quality of music to be obtained from receiving apparatus now that it is possible for the loud-speaker to handle the improvement.

Just recently our Research Department has been making an extensive series of measurements on various coupling devices and the amplification of complete receivers. The method of measurement can be described in a few words, although in practice it is not quite so easy to make the measurements as it would appear. The first task was to prepare a source of pure sine waves at all audio frequencies, which in itself involved months of work, but we have finally produced apparatus which can provide up to 80 or 90 volts and currents of the order of 5 or 6 mA at any frequency from 20 to 8,000, in which the harmonics are quite negligible.

The diagram reproduced in fig. 1 shows the connections for testing; the output from the audio source is applied, first, to a regulating potentiometer A, the output from which goes in turn to two resistances in series, one of 1,900 ohms and the other of 100 ohms. The receiver to be measured is connected across the 100-ohm resistance, and its output, after passing through a loud-speaker of the type for which the set is designed, is taken to a variable resistance R, of the order of from 100 to 1,000 ohms. A valve voltmeter can be connected by the switch B either across the resistance in the receiver output circuit, or across the 2,000 ohms in the output of the audio source. The potentiometer A is adjusted till the valve voltmeter shows 1 V across the 2,000 ohms, under which conditions the receiver has exactly one-twentieth of a volt applied to it. The voltmeter is then switched across R and R is adjusted until the reading is the same as before; from the value of R and the known voltage across it we can calculate the alternating current in the output of the receiver. The impedance of the loud-speaker at all frequencies is measured, and from this, the value of R, and the known a.c. resistance of the last valve of the receiver, one can easily calculate the total voltage generated in the anode circuit of the last valve. The ratio of this to the input voltage of 0.05 V is the amplification of the receiver.

Working in this manner, the curve of fig. 2 shows the performance of a set typical of dozens which represent the state of the broadcast receiver before the "revolution," although it must be said that sets of this kind are still being sold in certain quarters. The design of the l.f. end comprises two power valves and a detector, the couplings being by transformer in each case.

It may be well to note that in measuring this, and the

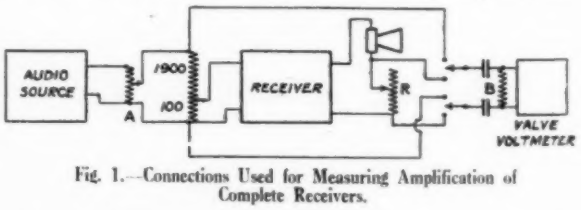

Fig. 1.—Connections Used for Measuring Amplification of Complete Receivers.

other sets of which we shall speak later, the amplification produced by the detector was included; in order to prevent disturbance due to rectification in this valve, the lower end of its grid leak was made 1 V negative instead of being connected to the filament positive circuit.

None the less, although this curve appears to be very bad, it is not quite fair to the set. It is fairly well known by now that the ear is not sensitive to change in amplitude unless special switch-over arrangements are made, and in practice it is hard to detect a falling-off in amplification until it amounts to about 50 per cent. in amplitude. In fig. 2 two points A A have been marked which represent the limiting frequencies on this basis, and it will be seen that the set

actually gives quite a fair performance between 400 and 6,000 cycles. From this it is obvious that the type of curve shown in fig. 2 does not convey to the eye a true impression of the quality of the set, for at a glance one would estimate the working range of this set at about 1,000 to 3,000 cycles. We have therefore prepared the curve of fig. 3, in which the vertical scale, instead of representing amplification, represents the "gain" of the amplifier in "transmission units."* Here, again, we have marked the points at which it may be said that the amplifier begins to show a perceptible falling-off, and it will be seen immediately that this curve gives to the eye a much more true representation.

For comparison with this old-fashioned set we now show the curves for two modern sets (see figs. 4 and 5). Fig. 4 represents about the best that can be got in the laboratory; this curve was for a set entirely resistance coupled, in which every precaution was taken to obtain the longest possible frequency range, and it may be said at once that the set is not a commercial proposition. It will be noted that the points at which a perceptible falling-off occurs are beyond the range of the curve shown; calculation based on the shape of the curve towards its ends shows that the falling-off becomes perceptible at about 20 and 16,000 cycles. With fig. 4 may be compared fig. 5, which shows the performance of a modern commercial set; the one actually measured was a standard Burndept "Ethophone III Mark IV." It will be noted that, although the range of even amplification is less than in the resistance-coupled set, none the less it extends from 28 to

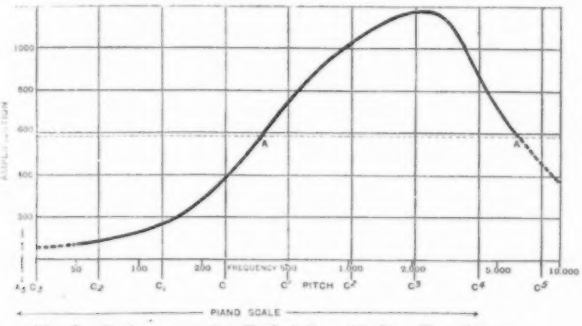

Fig. 2.—Performance of a Typical Set with Two Transformer Couplings; Vertical Scale showing Voltage Amplification.

7,000 cycles, thus covering the whole of the piano range and about an octave above it. It also has the advantage that the maximum amplification has been raised from about 600 to just over 1,000, as compared with the resistance-coupled set.

In practice it was very interesting to note the exceedingly small difference in audible performance between the two sets. For this purpose they were arranged so that an instantaneous change-over could be made by a single switch, the aerial circuits being adjusted until the strength of the output was the same for both receivers. No difference of any kind could be detected, except only in the case of double bass and the pedal notes of an organ, in which case there was a just perceptible difference in favour of the resistance-coupled set; however, it could only be perceived on a quick change over.

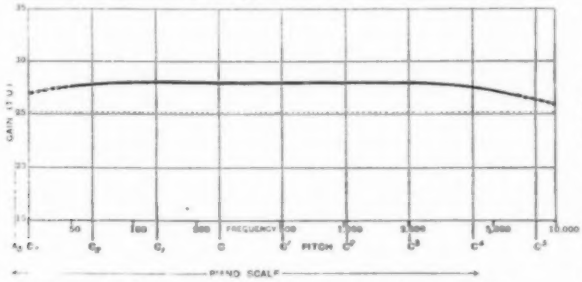

Fig. 4.—Performance of a Laboratory-type Resistance-coupled Set, Vertical Scale Representing "Gain."

When the listener walked out of the room and then returned, he was totally unable to detect which of the sets was in operation.

It may now be definitely concluded with regard to the extremely low notes that little, if any, improvement may be expected; nor, in fact, is it necessary. With regard to the extremely high notes, it would certainly be an improvement to extend the range slightly, though not greatly. The extreme frequency to which the ear is sensitive varies enormously in the cases of different individuals, but the average limit appears to be in the neighbourhood of from 9,000 to 10,000 cycles. There are, however, individuals who can hear up to 15,000 cycles, and for their benefit work is being done with a view to extending the upper range of modern receivers (the cause of the falling-off is quite well known). It may, however, be accepted that for ordinary music under ordinary circumstances a limit of 7,000 or 8,000 cycles is amply sufficient.

* A gain of 30 t.u. equals 1,000-fold amplification.

As to the means of getting such good results out of ordinary commercial sets, it is hard to point to any method of definitely ensuring it: it is simply a matter of care in every detail. Not more than one transformer can safely be used, and it must be of the very first quality. No attempt must be made to stabilise the set by the insertion of condensers across either the loud-speaker or the transformer; fixed resistors, not variable rheostats, should be used in the filament circuits; and it is absolutely essential to employ ample bias. Beyond this the problem simply becomes one of working out in detail the exact numerical values of every component, and making sure that the components used have the values so ascertained.

Decorative Electric Lighting.

The Nature and Use of Colour.

At a conference held at Newcastle on December 8th, under the auspices of the North-East Coast Area Sub-Committee of the British Electrical Development Association, Mr. W. G. Raffe read a paper on "Lighting as a Decorative Art." The chair was occupied by Miss C. Haslett, of the Electrical Association for Women.

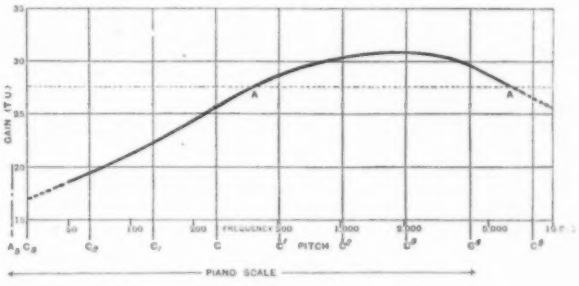

Fig. 3.—Performance of same Set as Fig. 2, but drawn to a Vertical Scale of "Gain" instead of Amplification.

Mr. Raffe said that the advent of lighting of a higher power necessitated better means of employment. It was possible nowadays to use light to express ideas and outlook just as clothing, furniture, and decoration could be used. One important development in modern lighting was the use of colour, and colour possessed qualities which were partly emotional and partly visible. To make his remarks more intelligible, Mr. Raffe proceeded to explain in simple terms the meaning of colour, and he dealt also with the nature of light. He said that light and colour had three principal qualities—hue, tone, and saturation—and it was the application of those three qualities which enabled colour arrangements to be harmonised or made discordant according to the user's knowledge. The hue of colour was that which

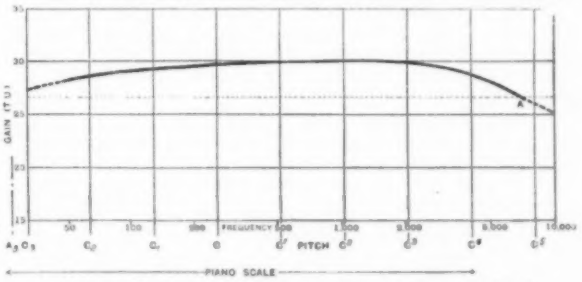

Fig. 5.—Performance of Modern Burndept Ethophone III Mark IV Set: Vertical Scale of Gain. The Second Point A Occurs off the Scale at about 28 Cycles.

distinguished light from an achromatic light, and the tone of colour was the light and shade variation by which it ranged from extreme white to extreme black. At the point where those two qualities met and crossed, the third factor of colour occurred—saturation. That occurred only at one point in any colour, and from the saturation point upwards and downwards were tints and shades. Light did not exist until it struck a medium, and its quality was altered by changes of media. In decoration, many changes could be made by the use of suitable media, and any organism would be affected by an intensification of a colour. Careful choice had to be made in the use of coloured light. As an example, the speaker quoted the use of yellow-tinted light over white linen. This, he said, would make the linen look yellowish, which was to be avoided. A great deal could be done by the use of box units in producing definite patterns on ceilings and walls. He deprecated attempts to copy natural lighting effects which resulted in invidious comparisons. A similar æsthetic effect could be obtained by using a decorative

light in a decorative manner. Dealing with home lighting, Mr. Raffe said that usually it was totally inadequate. How many people went to theatres, music halls, and similar places partly on account of the light and colour, and yet begrudged a small proportion of the expenditure for good lighting at home? More light was needed first of all, and then a discreet use of coloured light in various ways should follow. With regard to restaurants, no proprietor could afford to dispense with coloured lighting as a definite, integral part of the whole optical scheme. Coloured lighting, flood lighting on the outside, and spot lighting occasionally was necessary to attract patronage and keep it. Further, the same principle could be applied to towns, as it had already been applied to some pleasure resorts. Present-day street lighting was totally inadequate. Coloured lights could be used together or separately. Illuminating engineers would obtain some interesting effects if they used pattern and form for projection on to plain surfaces. The receiving surfaces could be mainly at right angles or tangential to the light source. Tubular lamps could be used on the frieze level or a strong light at the frieze diminishing lower down, and by the use of dimmers the intensity could be varied as desired. Modelled surfaces could be employed; so far, they had only been used in the floodlighting of architecture. At that point Mr. Raffe demonstrated the effects of coloured light on home decoration, fabrics, women's costumes, and the human face. A discussion followed, and in the course of his reply to points raised, the speaker said that ball-room lighting should be carried out in warm colours in winter, and "daylight" lamps would give a sense of coolness in summer. The use of large groups of vari-coloured lights at a reasonable height would give practically a white light. Some interesting effects were obtainable from mercury-vapour tubes and similar apparatus. For dining tables, Mr. Raffe advocated the use of a dual system of "daylight" and coloured lighting either of which could be used as desired. It was better to have six light sources than one, he thought. In conclusion, the speaker dealt with the medicinal value of colour, and gave examples of the beneficial use of light in the treatment of nervous troubles and in the cure of tuberculosis by artificial sunlight.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The "H" Type of Cable.

We have read with some amusement the article in your issue of the 17th inst. relative to the "H" type of cable, and the boosting therein of the idea of the wrapping with metallised paper or foil of the individual core coverings in a multicore cable, as though it were new.

We cannot understand how it can be that some cable makers have apparently only now discovered what they consider to be the merits of this application of a very old device, seeing that even this particular method has been public knowledge since so long ago as 1914. Can it be that the makers in question have only now commenced to think of super-tension cables and that, in order to do the thing thoroughly, they have wished to commence by going back to the beginning of things? However that may be, this company fully investigated the question of the use of screened-type cable for super-tension work years ago, and came to the conclusion that it was not advisable, at least for 33-kV cables—an opinion that they still hold.

It is admitted that some advantages accrue by the use of the device, but we consider that they are offset by the disadvantages, in that:—

If a cable is faulty in manufacture and consequently contains air or vacuous spaces in the insulation, the screening of the conductors only prevents the occurrence of ionisation outside the insulation of the individual cores, and does nothing to help to avoid this ionisation in the body of the insulation of the cores themselves. In fact, its use actually increases the liability of trouble in the core insulations by reason of the added difficulty of thoroughly drying and compounding.

The elimination of the tangential electrical stresses undoubtedly follows the use of a screen, but these are easily within the capabilities of the dielectric strength of the insulation in a well-made cable.

The screened type of cable is more costly to make than the belted type, apart from the cost of the screen, for the reason that the dielectric thicknesses between cores and to earth respectively cannot in the absence of a belt be kept in proportion to the working pressures; for instance, assuming for a given pressure the minimum allowable dielectric thickness to earth to be 0.35 in., then the "H" cable must have 0.7 in. between cores, whereas the belted-type cable can be made proportionally to the pressures and have 0.35 in. by 0.6 in. respectively. In this respect the illustration in your article showing the two types of cable of the same size is misleading, if it is suggested that they are for similar working pressures.

The three-core type of cable is essentially unmechanical, and in the absence of a substantial binding belt the three separate cores are readily displaced relatively to each other by the bending or handling of the cable. The lead covering in itself is no preventative of this, as it is a ductile metal practically without elasticity, and so a cable made without a belt will be found to be visibly triangular after only moderate handling. The working of the lead covering in the way indicated can only have the effect of increasing its cubic contents, and so causing air or vacuous spaces, however well the sheathing may have been filled when the cable left the lead press. This being so, then when the cable is heated in use, the compound will gravitate to the bottom of the sheath or down a hill, and so may drain the insulation of an individual conductor even beneath its screening.

The table of curves accompanying your article, showing the relative performance of the belted and "H" type cables in the matter of the variation of power factor with voltage, is most unfair to the former. We cannot imagine that so bad a cable of the belted type as these tests show can have really ever been made, but however this may be, the test on the "H" type showed a rise in power factor from about 0.007 at 30 kV to about 0.0095 at 50 kV (the scale is small), whereas official tests made by the Birmingham Corporation on some 33,000-volt cable of the belted type supplied to them three years ago gave 0.0072 power factor at 33 kV and only 0.0079 at 55 kV, and some tests on more recently made belt-type cable for the same working pressure showed 0.0066 power factor at 33 kV and 0.0077 power factor at 66 kV."

Incidentally, this seems to us to dispose of the claim that the "H" type of cable will carry more current than the belted type by reason of its lower dielectric losses, and the only remaining advantage it can have in this respect is by reason of the heat conduction capacity of the very thin and divided film of metal in the screening. As a matter of fact, actual heating tests on cables having a 5-mil thickness of copper screening proved conclusively that it is more economical to provide any additional carrying capacity that may be required by adding metal to the conductors rather than as a heat conveyor from the dielectric.

There are other points, but we have already severely trespassed on your space to an extent we would not have dared to do but that we know great interest is being taken in this subject at the present time.

British Insulated Cables, Ltd.
G. H. NISBETT, *Director and Engineer.*

Prescot, Lancs., *December 20th*, 1926.

The Power Supply of Wireless Sets.

With reference to recent letters on the above subject, it would probably be of interest to intending users of h.t. Leclanché batteries to record my experience with such cells.

For some 30 years I have been using Leclanché 3-pint cells for bell work, employing as the exciting liquid "Siebrosal," a special salt supplied by Messrs. Siemens Bros. & Co. for such purposes, which has the important property of preventing creeping of the liquid and deposition of crystals as usually experienced with ordinary salammoniac.

The cells have always been slightly vaselined inside above the liquid level and round the tops, and I have never found the slightest signs of creeping of the liquid or deposition of crystals; once a year about 1 in. of water was added to make up for evaporation. So satisfactory had been my experience that I decided to make up a battery of small Leclanché cells, and purchased from Messrs. Siemens Bros. & Co. 54 of their HT.1 size. These were placed in a box with the lid raised about ¼ in. all round for ventilation, the cells being spaced from each other about ¼ in. by paraffined cardboard strips placed along the bottom of the box. When assembling the cells the linoleum cork caps were well paraffined, and the glass containing-cells vaselined around the tops.

The exciting liquid was inserted with a fountain-pen filler through the small holes in the top of the corks, the holes then being nearly closed with a cork plug having a groove in it for the escape of gas.

The cells when made up gave about 80 volts, and they have been in continual use for two years, supplying h.t. current to one 0.06-amp. l.t. valve for 3-5 hours daily.

About a year ago I used them for testing a number of 200-volt, 20/60-watt lamps, the filaments of which they rendered bright red. After two years they still run a 30-watt lamp nearly as brightly, although I estimate that the voltage has dropped to about 65.

There is no sign of creeping or evaporation of the liquid, and the cells have given most satisfactory service.

I should have no hesitation whatever in recommending the use of such cells for h.t. service provided that they were installed of sufficient capacity and properly made up and insulated in the first instance.

Where one has the means of charging one's own cells or of getting them charged locally, accumulators are the ideal if properly treated. When, however, charging facilities are not available, then, in my opinion and as the result of many years' experience, Leclanché batteries are not to be beaten.

Where trouble has been experienced with such cells, I should suppose that it has been due almost entirely to the use of salammoniac instead of a special salt made up to prevent creepage. I guarantee that cells of sufficient capacity would give many years of useful service if every care was given in the first instance to small details in assembling, and (*vital point*) the use of the right excitant.

W. J. Ormston.

London, *December 24th*, 1926.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Trade Names Supplement.—The third of our quarterly Supplements of Electrical Trade Names is published with this issue of the ELECTRICAL REVIEW.

The "Electrical Review" Index.—The Index to Vol. XCIX (for the half-year ending December 31st, 1926) is now in preparation, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes, or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.

E.D.A.-E.L.M.A. Campaign.—No official report upon the progress of the E.D.A.-E.L.M.A. Campaign during last week was issued, but a correspondent informs us that in the South-Midlands Area it is hoped to bring the total number of demonstration houses up to fourteen soon after the holidays, and four more local circles are being formed at Loughborough, Chesterfield, Shrewsbury, and another centre. Two demonstration houses at Walsall are to be opened on January 1st by Councillor Thicket, chairman of the Walsall Electricity Committee, and two will shortly be opened at Leicester. The Shropshire, Worcestershire and Staffordshire Electric Power Co. is extending the series of electrical exhibitions which it has been holding in rural and other centres, and exhibitions are to take place at Barnt Green and Ludlow, Droitwich, Evesham, and Halesowen, at each of which the campaign will be kept well to the fore. An exhibition was held by the company at the Egyptian Hall, Dudley, from December 15th to 24th, and it attracted a large number of visitors. The company has disposed up to the present of nearly 3,000 competition booklets. As a result of the two Nottingham demonstration houses, the local contractors are experiencing a steady flow of orders.

Our illustration depicts what appears to be quite an ordinary house, but it is one that has achieved a record in the campaign. It is the demonstration electric home arranged by the Huddersfield committee, and up to December 17th it had

The Huddersfield Demonstration House.

been visited by 20,000 people, representing about one-fifth of the Huddersfield population. If other demonstration houses attract as good a proportion of the people there will be no doubt as to the success of the campaign.

The Radio Manufacturers' Association.—The newly-elected Executive Council of this Association held its first meeting on December 15th, when the following officers were elected:—Chairman, Mr. W. H. Goodman (Dubilier Condenser Co. (1925), Ltd.); vice-chairman, Mr. A. E. Bowyer-Lowe (Bowyer-Lowe Co., Ltd.); trustees, the chairman, Mr. J. Joseph (Radio Instruments, Ltd.), and Mr. J. T. Mould (Granic Electric Co., Ltd.); secretary, Mr. D. Grant Strachan; auditors, Messrs. Derbyshire & Co.; legal advisers, Messrs. Kenneth Brown, Baker, Baker. The Council decided to co-opt representatives of the following companies:—The Chloride Electrical Storage Co., Ltd., the Marconiphone Co., Ltd., and the Radio Communication Co., Ltd. The New Hall, Olympia, was booked for a period in each of the next five years. It was decided that arrangements should be made for the issue to members of a monthly Bulletin containing information of a confidential nature on various topics. By the co-opting of the three above-mentioned companies, the Executive Council now consists of 15 members.

The Irish Radio Import Duty.—The Radio Association of Cork City recently passed a resolution calling for the abolition of the duty on wireless goods imported into the Irish Free State on the grounds that it is impeding the development of radio, that it is not a productive tax, that it is unjust to impose a tax on wireless goods returned to manufacturers in Great Britain for repairs, and that it is a direct means of preventing an increase in the number of wireless licences, and thus actually causes a loss to the Free State.

Battery Contracts.—The ALTON BATTERY CO., LTD., reports that its sales during 1926 were more than double those of the previous year; they included orders for batteries for Australia, India, Ceylon, Federated Malay States, Wales, and for four telephone exchanges in this country, as well as for materials for renewals in other cases at home.

Polish Foreign Electrical Trade.—The official returns of Polish foreign trade for October last show that "apparatus, conductors, and other electrotechnical materials," valued at 3,225,000 gold zloty (£128,000), were imported during the month, while similar materials, valued at 30,000 zloty (£1,200), were exported.

"Frigidaire" Showrooms at Birmingham.—In a recent issue we reported the opening of new showrooms at Corporation Street, Birmingham, by the Delco-Light Co. for the display of its "Frigidaire" apparatus. We are now able

"Frigidaire" Apparatus at Birmingham.

to reproduce a view of one of the rooms of these premises in which a number of models for domestic and commercial use are exhibited.

Beautifying Industry.—From the beginning of last century up to a few years ago smoke, dirt, and fumes were looked upon as natural concomitants of industry. In later years, however, there have been glimmerings of the untruth of this, and more and more is done nowadays to carry on manufacturing processes in healthy and congenial surroundings. An example of this tendency recently brought to our notice is the works of the Excelsior Shade Manufacturing Co., West Bridgford, Nottingham. A photograph which has been sent us depicts the offices and works set amid beautiful lawns and gardens, a situation which should surely produce healthy and satisfied workers.

Electricity in Tin Mining.—Speaking at the recent annual meeting of a Malaya tin-producing company, Sir E. W. Birch said that the conversion of the company's remaining dredges from steam to electricity, with the resultant increase of efficiency, gave the directors every confidence in the future success of the company.

At the annual meeting of another company (Rahman Hydraulic Tin, Ltd.), the chairman, Col. C. Rae, referred to the company's hydro-electric scheme, and said that this would prove a great asset in view of the rising prices of coal and oil, and would enable the company to treat material at a very low cost.

An Anglo-Argentine Company's Jubilee.—This month the Anglo-Argentine Tramways Co., Ltd., celebrates its jubilee, the company's registration dating from 1876. It commenced operations in Buenos Aires with horse-drawn cars, the approach of which was heralded by two outriders. The conversion of the system to electric traction was commenced in 1900, and the change-over was completed in 1904. The growth of the traffic in Argentina soon became a serious problem, and this was partially solved by the construction of subways by the company, the first of which was opened in 1913. The population of Buenos Aires has grown during the company's existence from about a quarter of a million to about two millions, and the company's business has progressed at an even faster rate. In the first year of running the company carried 1,800,000 passengers; in 1925 the total was 559 millions. The company now has a total issued capital of over £21,000,000.

On December 21st two functions celebrating the jubilee were held simultaneously in London and Buenos Aires. Lord Wargrave presided in London, in the absence of the chairman, Sir G. A. Touche, and Mr. W. D. Dawes, managing director, responded to the toast of "The Company," proposed by Lord Wargrave.

Irish Free State Electrical Imports.—The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports for the first nine months of the current year, with a comparison with the corresponding period of 1925. From these we have compiled the appended table showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as country of shipment, but not necessarily of manufacture:—

	Total nine months.		U.K. share.	
	1926.	1925.	1926.	1925.
	£	£	£	£
Electric wire and cables ...	81,402	81,732	47,720	68,757
Telegraph and telephone instruments and apparatus	33,003	21,279	28,897	21,074
Electric lamps and parts...	40,157	38,440	36,616	37,931
Batteries and accumulators	26,401	22,063	23,144	20,666
Radio sets and parts ...	69,413	34,964	66,141	34,023
Other electrical goods and apparatus	77,311	50,549	50,153	48,117
Generators	24,277	10,660	7,263	10,147
Motors	28,907	18,853	17,242	18,316
Other electrical machinery	54,727	51,887	42,978	45,719
Totals	435,598	330,427	320,154	304,750

It will be seen that, with the single exception of electric wires and cables, the importation of all classes of goods showed a marked advance over 1925, the total of £435,598 representing an increase of £105,171. Of the imports, £320,154, or approximately 75 per cent., came from ports of the United Kingdom, leaving £115,444 for foreign countries. Of this balance the bulk (£103,513) is credited to Germany, £250 to Belgium, and £1,581 to "other countries."

New Italian Companies.—Among the hydro-electric undertakings recently formed in Italy are the Società Idroelettrica Val Borlezza, Milan, capital one million lire; the Società Idroelettrica Valmaremola, Milan, capital 385,000 lire; and the Società Idroelettrica Ligure Piacentina, Genoa, capital 20 million lire.

Among the new telephone companies are the Società Telefonica Elettrica Ligure Lombardi, Milan, capital 100,000 lire; the Società Impianti e Manutenzioni Elettriche e Telefoniche, Florence, capital 100,000 lire; and the Società "Step" Telefono Esercizio Privato, Turin, capital 300,000 lire.

Lamp Prices in Germany.—It is announced from Berlin that the leading makers of glow lamps have introduced new price lists for Germany as from December 20th and rearranged the sale conditions for dealers. On the average the new arrangements represent a reduction in the list prices amounting to 8 per cent.

A Novel Lamp-Selling Scheme.—Memphis, Tennessee, in the cotton belt of the United States, has a population of about 170,000. This being so, it was therefore a remarkable achievement of the Memphis Power and Light Company to carry through a campaign lasting one month that resulted in the sale of 43,000 of a new type 60-W lamp of a well-known make. For this special campaign no recourse was made to other than the company's usual sales organisation. Its main feature consisted in the delivery personally by a salesman to every house of a card bearing the following wording:—

How Often Have You—
Shopped all day long—
Remembered the coffee for breakfast—
Remembered the thread for your dress—
Remembered the prize for your bridge drive—
—Forgotten Those Lamps!

A regrettable experience, but one we all have. To introduce these wonderful new —— and to help you Remember Lamps, we are making

Our Special
Introductory Offer—

Tear off, stamp and mail the attached post card, or telephone 4-7980, and we will send you at once a carton of six 60-watt (the standard size for all homes) New —— lamps. We will then charge your account $1.92, which is 32 cents per lamp, and render you a bill for 48 cents each month for four months to cover the purchase.

Tear off This Card.

This offer will be seized by hundreds of your friends. Mail this card immediately, and your order will be promptly filled. The careful housewife *always* keeps lamps on hand!

ACT TO-DAY!

When the reply postcard attached was received, the lamps were delivered by one of the company's own vans. Considerable use was made of posters and of other forms of advertising, whilst the salesmen were stimulated to more persuasive eloquence by the offer of prizes for those who obtained the highest volume of sales. Not only was this campaign a great immediate success, but it has had the sequel of teaching the housewives of Memphis that it pays to buy lamps by the carton instead of one at a time, and that it also pays to keep a reserve in the house for emergencies. The Memphis Power and Light Company is so pleased with the results obtained that it proposes to repeat the experiment at more or less regular intervals.

Advertising House-Wiring by Poster.—Hitherto house-wiring systems have generally been advertised to the contracting industry on the assumption that the public was not very interested in the means so long as results were obtained. A recent development by the MACINTOSH CABLE CO., LTD., is therefore in the nature of a new departure in this direction. It consists of a 16-sheet poster in five colours for public hoardings. It portrays a typical modern house with every window illuminated, and draws attention to the advantages of the Macintosh wiring system. It is being specially employed in recently-electrified districts.

Wages in the Electricity Supply Industry.—In accordance with the terms of settlement adopted by the National Council for the Electricity Supply Industry in 1921, the next wages revision will take place as from January 1st, based upon the average of the cost-of-living index figures as published in the *Labour Gazette* in the three preceding months. This average is 77¼ per cent., which, if deducted from the datum figure of 120, leaves 42¾ points, or 7 cycles of 6 complete points. There have been 8 variations (net) to date; there will therefore be an increase of ¼d. per hour in the rates of the grades set forth in the Schedule of Rates as from January 1st.

Important Railway Contract for the Metropolitan-Vickers Company.—One of the largest contracts for complete electric railway equipments ever placed in this country has been obtained by the Metropolitan-Vickers Electrical Co., Ltd., in connection with the extension of suburban electrification on the Southern Railway. It covers the supply of motors, control gear, lighting, heating and braking equipment for 116 three-coach trains and 47 two-coach trailer units for passenger service on the central section of the system. The value of the contract, over £600,000, is approximately the same as that of the recent contract placed with the same company for 41 2,600-h.p. locomotives for the Great Indian Peninsula Railway. The whole of the electrical equipment for both contracts will be manufactured at the works of the company at Trafford Park and Sheffield. The trains used on the Southern system are made up of three-coach units. Each unit consists of two motor coaches, with a trailer between. Trains consisting of one, two or three of these units, or eight coach trains consisting of two train units with two trailer coaches between, are used as required.

The present contract is the fourth of considerable magnitude which has been placed with the company by the Southern Railway. The first, in 1914, covered complete motor and control equipments for 84 three-coach trains constituting the initial stock for the south-western section to Shepperton and Claygate. In 1924 and 1925 control equipments and auxiliaries were supplied for 129 three-coach trains and 59 two-coach trailer units for the south-eastern section. A later contract was placed in 1925 for equipments for 26 three-coach trains and 13 two-coach trailer units for the Dorking and Guildford extensions on the South-Western section. This last contract included Metropolitan-Vickers motors, as does the present contract. The new equipment will be identical with that supplied for the previous contracts. Each motor coach will be equipped with two 275-h.p. motors of the totally-enclosed, self-ventilating type. These machines are arranged in pairs on the bogies underneath the driving compartments at the two ends of the train unit. As with most axle-mounted motors, they are four-pole machines, and have also four commutating poles and two sets of brushes. They are series wound for operation at 600 V d.c. The control gear is of the Metropolitan-Vickers all-electric type, with automatic acceleration, arranged for multiple-unit working. The main contactors are operated by solenoids energised from the line and controlled through train lines connected to the master controller in the driver's cab. The master controller incorporates a "dead-man handle" which automatically shuts off the power and applies the emergency brakes should the driver's hand be removed. It is of interest to note that the maintenance cost on the equipment already installed, much of which has been in continuous service for periods up to 12 years, has been extremely low, probably the lowest of any railway in the world.

Employment During November.—The *Ministry of Labour Gazette* reports that employment in the engineering industry during November continued to be affected adversely by the coal dispute, and upon the whole there was no change from the October conditions. In the electrical and motor branches conditions continued to improve slightly, but in the marine branch there was a further decline in employment. The statistics show that, whereas for the engineering industry as a whole the proportion of unemployed was 16.7 per cent., the figure for the electrical engineering section was 6.8 per cent., as compared with 7.1 per cent. in October and 5.6 per cent. in November, 1925. In the electrical wiring and contracting industry the percentage of unemployed fell from 9.7 to 8.7; in November, 1925, the figure was 6.6 per cent. There was a slight increase in unemployment in the electrical cable, wire and lamp manufacturing industries—from 7.4 to 7.9 per cent., as compared with 5.5 per cent. in November, 1925

Unemployment.—The total number of unemployed at December 13th was 1,410,700. This represented a decrease of 95,620 during the week, but was 283,254 more than at December 14th, 1925.

A Large Radio Installation.—The idea of wiring houses for radio reception is gaining ground here, but in the United States it appears to have been acted upon on an elaborate scale. *Electrical Merchandising* recently described an installation fitted in an apartment house in San Francisco which cost $10,000. The building is a ten-floor construction with a hundred apartments. The receiving set is situated in the entrance lobby and loud speakers are arranged in ten groups of ten (a group for each floor). In 100 rooms a loud speaker is set in a compartment specially provided in the wall and it is covered with a neat metal grill so that it is entirely out of the way. Each instrument is, of course, controlled by the occupant of the room. A compensating arrangement is provided to control the volume.

An Edinburgh Exhibition.—An Empire Exhibition is to be held in the Waverley Market, Princes Street, Edinburgh, from July 27th to August 6th next. The director is Mr. W. J. Stoddart.

Trade Announcement.—Major A. M. DEAKIN has been appointed sole agent for "A.J.S." wireless sets and accessories for the Birmingham area, and has opened premises at 6, Colonnade Passage, New Street, Birmingham.

Book Notices.—"Mechanical Year Book, 1927." Pp. 318; figs. 106. London: Messrs. Emmott & Co., Ltd. Price 1s. 6d. net.—Several new sections have been introduced in the new issue of this handbook. One deals with rails and wheels, and gives many useful data on the subject. Another new section treats of belt conveyors, while the section on toothed gearing has been rewritten. The sections dealing with condensing plant and structural steelwork have also been subjected to much revision. The usual mathematical and other tables are included, as well as the diary and memoranda for 1927.

The special December issue of the *Fuel Economist* reprints the speeches made and papers read at the inaugural meetings of the Institution of Fuel Technology on December 7th and 8th. It is issued from 37, Lowndes Square, S.W.1, price 2s. 6d.

"Electric Circuit Theory and the Operational Calculus," by J. R. Carson. Pp. ix+197; figs. 32. London: McGraw-Hill Publishing Co., Ltd. Price 15s.

Technologic Papers of the U.S.A. Bureau of Standards. No. 325, "Recent Developments in Lamp Life-Testing Equipment and Methods." Price 15 cents.

"Overhead Electrical Transmission Lines: Strength of Wooden Poles, &c." Revised and enlarged edition of "Wade's Tables." Hull: Richd. Wade, Sons & Co., Ltd.

Catalogues and Lists.—W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1.—Publication U.G.2, containing illustrated details of colliery cable boxes and fittings. The list includes both disconnecting and non-disconnecting types and gives specifications and jointing instructions. One of the disconnecting boxes is illustrated in colours to show the pole- or phase-distinguishing methods employed. Another catalogue in the same *format* (W.A.1) issued by the company deals with Henley distribution pillars and panels of the unit type. This, too, has some coloured illustrations.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Circular No. 1,785/4, containing numerous illustrations of loom motors and drives installed by the company in textile mills, with descriptive notes.

M. PAUL DIENY, 21, Laurence Pountney Lane, E.C.4.—An illustrated pamphlet describing the "Ejectowater" air condenser.

CARRON COMPANY, Carron, Falkirk.—An electric heater catalogue containing prices and illustrations of many designs for home and industrial use.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield.—List No. 1,890, dealing with the company's patent sheltered seat "Flexible" try cocks for water gauges.

THE PARSONS OIL ENGINE CO., LTD., Town Quay Works, Southampton.—A price list of electrically-operated pumps; three sizes—½ in., ¾ in., and 1 in.—are dealt with.

ELECTRICAL DEVICES, LTD., Powdene House, Pudding Chare, Newcastle-upon-Tyne.—Two trade price lists dealing respectively with electrical wiring materials, lighting fittings, domestic appliances, &c., and with radio sets and accessories.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—An illustrated and priced booklet issued in connection with the company's special domestic-appliance campaign. It contains particulars of fires, cookers, irons, kettles, and many other devices, and details of running costs are given.

BRUNTON'S WIRE ROPE WORKS, Musselburgh, Scotland.—A price list of wire ropes for cranes.

THE NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, S.W.4.—A cheque-book blotter advertising small electric motors, with a January calendar.

MESSRS. WALTER MCGEE & SON, LTD., Albion Works, Paisley.—A series of illustrated pamphlets describing "Emcol" a.c. motors of various patterns, including machines for use in mines.

Calendars and Diaries.—To the many friends who have sent us the Compliments of the Season we desire to express our thanks, and to these, as well as to all our advertisers and readers, we wish a "Happy and Prosperous New Year." We have again pleasure in acknowledging receipt of a large number of souvenirs.

MESSRS. VENNER TIME SWITCHES, LTD., have sent to their customers as a Christmas souvenir a giant pencil which will never get lost, and will take a long time to wear out.

MR. L. W. FOOTE, 30, Charles Street, Cardiff, has sent us a calendar which bears a reproduction of a beautiful water-colour drawing by W. H. Margetson, R.I., illustrating "The Iron Chest" (*Grimm's Fairy Tales*). The calendar has a set of monthly slips.

"Good Judges" is the title of the picture which appears on a calendar received from Mr. ERIC THOMPSON, Thirsk. It is a reproduction of a painting by Frank Dadd, R.I., and shows two soldiers admiring a serving wench.

The Engineering Department of Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., has prepared a handy and attractive blotter book, with a cover of artistic design in colour, with a "Henley" street box in the foreground.

The wall calendar circulated by Messrs. T. J. GRAINGER AND CO., LTD., of Newcastle-on-Tyne, has a block of boldly-printed daily date slips.

From MESSRS. LINDSAY & WILLIAMS, LTD., Bennett Street Works, Ardwick, Manchester, we have received a wall calendar with a block of "Mammoth" daily slips.

THE ARORA CO., of Loughborough, has sent us a neat miniature pocket diary for 1927.

A well-produced and useful pocket diary ("Collins' Compact") has been received from Messrs. JOHN ARMSTRONG AND CO. (MANCHESTER), LTD., of Barton Square, St. Ann Street, Manchester.

From the ELECTRICAL POWER ENGINEERS' ASSOCIATION we have received a diary and memoranda book, with useful data, attached to a note-book after the fashion of the Siamese twins.

The IGRANIC ELECTRIC CO., LTD., has sent us a set of tear-off memoranda slips in a neat morocco pocket case, which can be refilled.

From the MARCONIPHONE CO., LTD., we have received a calendar bearing a *bas relief* of a "Marconi" valve—the glass being represented by polished metal. Below this is a set of six-day slips with white figuring on a black ground. The company has also sent us a pack of "Radio Banker" playing cards.

A small plain and businesslike wall calendar (monthly slips) has been received from Messrs. JOHNSON, CLAPHAM AND MORRIS, LTD., of Manchester.

The 1927 calendar of the NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. consists of a set of weekly date pads as in previous years, with a month's dates also on each slip.

A neat vest-pocket diary in black and gilt has come to hand from the WESTINGHOUSE ELECTRIC INTERNATIONAL CO. Inset is a map of the world showing aerial distances between different places.

A serviceable desk memo. calendar for 1927 has been received from Mr. FERNAND ESPIR, 86-88, Queen Victoria Street, London, E.C.4. It consists of a block of daily permanent slips on a raised wooden base bearing the name-plate Tréfileries et Laminoirs du Havre.

The 1927 calendar of the MULLARD WIRELESS SERVICE CO., LTD., is again a cardboard representation of a "Mullard" valve, with a block of daily slips. The valve has a single electrode—a pretty girl.

We again welcome the calendar-blotter sent to its friends by the HART ACCUMULATOR CO., LTD. This is bound in red cloth and has a calendar for the whole year on each sheet.

The company's calendar for 1927 has as its main feature a pastel reproduction of a lady's head. It is provided with large monthly slips.

A handsome pocket diary with pockets and insurance policy form has come to hand from the EDISON SWAN ELECTRIC CO., LTD., of 123-125, Queen Victoria Street, E.C.4.

Bankruptcy Proceedings.—H. L. SMITH, electrical engineer, 156, Tredegar Road, Bow, and lately of 10, Ordell Road, Bow.—This debtor attended before Mr. Registrar Mellor at the London Bankruptcy Court on December 21st for public examination upon accounts showing liabilities of £1,552, against assets valued at £28, apart from bad book debts, £61. Replying to the Official Receiver the debtor stated that before the war he carried on business as an electrical engineer. From 1915 until 1919 he served with the forces and on his return to civil life he recommenced the electrical business, but by reason of wounds he was severely handicapped, and was compelled to employ a manager. He had been insolvent since 1919 or 1920, and had continued to trade in the hope that his business would improve. A number of County Court summonses were issued against him, and in order to pay creditors he sold goods at less than cost price. On September 21st, 1926, he called a meeting of his creditors and offered to pay them 5s. in the £, at once, and the balance within a year. This offer was generally accepted, but one creditor issued a writ, whereupon he filed his petition. The debtor attributed his failure to illness resulting from his wounds, bad debts, and loss sustained as the result of a "long firm" fraud. The examination was concluded.

C. W. WATSON, 33, Rainhall Road, Barnoldswick, Yorks., electrical and wireless engineer.—The public examination of this debtor was held on December 20th, at the County Court, Bradford. According to the statement of affairs there was a deficiency of £776. It appeared that debtor commenced business at his present address in January, 1925, and his turnover, at first £30 a week, later increased to £50 weekly. This year, however, it had dropped to £15. His gross profit was 15 per cent. In the last year many writs had been issued against him, and his costs in connection with executions totalled £140. The examination was closed.

R. P. REEVES, trading as the Luxray Spotlight Projector Co., 5, Say's Corner, North Quay, Great Yarmouth, electrician.—The public examination of this debtor was fixed to be held recently at the Town Hall, Great Yarmouth. The liabilities were returned at £1,041, and there was a deficiency of £954. Debtor did not appear, and the case was adjourned.

A. J. CULLUM, motor and electrical engineer, 34, Mount Pleasant, and 8, Church Street, Diss.—Receiving order made December 16th, on debtor's own petition.

W. H. DICKSON and A. J. SOLOMON (Dickson & Solomon), electrical and wireless engineers, 13 & 14, Tavistock Street, Plymouth.—First meeting held December 31st, at 11, St. Aubyn Street, Devonport. Public examination January 28th, at the Western Law Courts, Guildhall, Plymouth.

M. KELLY, radio apparatus dealer, 12, Jackson's Row, Manchester.—Last day for proofs for dividend January 5th. Trustee, Mr. J. F. Warburton, 28, Queen Street, Manchester.

J. ADDY, wireless and cycle dealer, Bridge End, Long Preston, York.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released December 15th.

A. H. MONCRIEFF, wireless manufacturer, late of 60, Thornton Road, Bradford.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released December 15th.

Company Liquidation.—RADIO PHONOPORE & ELECTRICALS, LTD.—Last day for proofs for dividend, January 8th. Liquidator, Mr. M. C. Spencer, 3, Fredericks Place, Old Jewry, E.C.

Private Arrangements.—BESSIE A. CHRISTIE, widow, trading as J. C. Christie, 3-5, Mansell Street, E.1, wholesale radio and electrical contractor.—A meeting of creditors was held on December 17th at the offices of the United Association, Ltd., Leadenhall Street, E.C., when the chair was occupied by Mr. E. H. Hawkins, representing one of the largest creditors. A statement of affairs was presented, which showed liabilities of £8,675, of which £5,860 was due to the trade, and there were also fully-secured creditors for £9,511. The net assets were valued at £7,932, leaving a deficiency of £742. It was stated that Mr. John Christie, the husband of the debtor, died in 1905, and a brother died in 1903, and since that time the business had been carried on by managers for the widow; there were no private assets belonging to the debtor outside the business. In 1922 a profit of £3,600 was made, but of that amount £1,600 was a refund by way of excess profits duty. Since then the firm had always made a loss. The turnover had averaged between £26,000 and £30,000 a year. According to a balance-sheet, as at June 20th, 1922, the capital was £12,500, and during 1923 and 1924 further cash was put into the business amounting to £2,280. At June 30th, 1926, the business appeared to be solvent, and after taking in the value of the property there was a surplus of £4,600. Members of the family who were loan creditors were willing to postpone their claims, amounting to £2,814, until the creditors had been paid in full. The accountant said that his firm was instructed by a creditor to look into the affairs of the concern, and on its advice a deed of assignment was executed and registered on December 16th. Several writs had been issued, but no judgments had been obtained. The L.C.C. at the present time owed the debtor about £2,000 for work done. A creditor proposed that the deed already executed should be confirmed subject to a committee being appointed and to Mr. E. H. Hawkins being appointed joint trustee. The proposal was agreed to. The committee of inspection consists of Messrs. Suggs & Co., Fletcher Russell, Ltd., N. Pearson, the London Scottish Foundry Co., and Mr. Ball, representing creditors.

R. E. R. PETHEN, trading as the Essanco Instruments Manufacturing Co., wireless manufacturer, 13b, High Road, Kilburn, N.W.6.—A meeting of creditors was held on December 22nd at the offices of Messrs. G. Butcher & Simon Burns, solicitors, Gresham Street, E.C. No statement of affairs was presented, but Mr. Burns reported that the liabilities were approximately £550, whilst the assets consisted of a small quantity of tools, office furniture, and stock. Up to a recent date the debtor was a clerk; he agreed to take over the present concern, pay £230 for the business, and discharge certain liabilities. The debtor paid a deposit of £15 on account of the purchase price, and agreed to discharge the balance out of future profits. In a short time the debtor found himself in difficulties, and he endeavoured to effect an arrangement with the creditors. A deed of assignment had already been executed to Mr. R. A. Rodgers, of the Society of Trade Creditors, Coventry House, South Place, Finsbury, E.C. Mr. Rodgers stated that arrangements could be made for a third party to take over the business and pay the creditors a dividend of 10s. in the £ out of future profits. That proposal was adopted, and the deed of assignment executed to Mr. Rodgers was confirmed. The following are creditors:—

	£		£
Scott Insulated Wire Co. ...	71	Hughes & Co., Ltd.	24
Sturtevant & Co.	25	Saxonia Electrical Wire Co., Ltd.	26
Voss & Michael	89	General Engineering Co.	147
Bissell & Co., Ltd.	56	Dickinson Electric Mfg. Co., Ltd.	40
Moor & Latham	25		
Scott, Baynes & Co.	92		

The Australian Power Workers' Strike.—As we reported last week, the strike of the workers at the Yallourn (Melbourne) power station ended on December 19th. The conditions of settlement are an increase of 6s. per week all round for a 48-hour week.

Chinese Notes.—An engineering exhibition was held at the Nanyang University, Shanghai, in October. Forty-two firms participated, about half of them being Chinese. The latter included the Chinese National Engineering and Manufacturing Co., which showed fans, motors, switchgear, &c., and the China Electric Co., Ltd., which displayed electrical supplies of various kinds.

The Soochow Electric Co. recently amalgamated with the Chenghsin Electric Light Co., and has taken new premises. The company has a capital of $2,200,000, and supplies energy at 200 and 400 V from a steam turbo-generator.

The Shanghai Electric Construction Co., Ltd., and the Cie. Française de Tramways increased their fares recently to counteract the depreciation of the copper exchange.

The Dairen Telephone Administration has ordered the necessary equipment from America for the installation of an automatic system; this was expected to be completed before the end of the current year.

The Peking Tramway Co. reports a loss of $62,000 on the past year's working.

The Registration of Business Names.—The report of the Comptroller of the Companies' Department of the Board of Trade for 1925 states that the number of applications in respect of the registration or alteration of business names from 1917 to 1925 inclusive were 224,479 and 43,006 respectively, in England, and 23,442 and 3,689, respectively, in Scotland. At the close of the year there were 192,252 English and 21,090 Scottish names on the register.

Glasgow's Contribution to E.D.A. Funds.—The Glasgow Corporation electrical engineer having reported upon the publicity and other work carried out by the British Electrical Development Association, the Electricity Committee recommends that the contribution by the Electricity Department to the funds of the Association be renewed for the current year, the amount being £1,172, *i.e.*, one-tenth of one per cent. of the revenue of the department.

American Vacuum Cleaner Sales.—The (American) Vacuum Cleaner Manufacturers' Association reports that during the first nine months of the current year 745,320 vacuum cleaners were sold in the United States, as compared with 610,914 in the corresponding period of 1925.

Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 22nd, 1926:—

Premier. No. 468,284. Class 13. Metal electrodes for use in electric welding.—Premier Electric Welding Co., Ltd., Abbey Wood, S.E.2.

Tempter Spark Plug (lettering and design). No. 475,329. Class 13. Spark plugs.—Tempter, Ltd., 6a, Clare Terrace, Earl's Court, S.W.5.

L.E.C. Liverpool (lettering and design). No. 474,578. Class 16. Electric junction boxes made of earthenware. No. 474,458. Class 20. Electric junction boxes and casing for surface wiring, all being made of wood.—Liverpool Electric Cable Co., Ltd.

Etheron. No. 475,189. Class 40. Goods manufactured from india-rubber and gutta-percha.—St. Helens Cable and Rubber Co., Ltd.

Local Exhibitions.—WOOLWICH.—A highly-successful campaign has recently been conducted under the *ægis* of the Borough Council. The Electricity Supply Department displayed electrical household appliances, lamps and fittings in the show windows of its premises, and an exhibition was held by the Department in conjunction with the General Electric Co., Ltd., at the Woolwich Town Hall, from December 6th to December 22nd. Practically every "Magnet" household appliance manufactured by the company was exhibited, including not only the smaller domestic units such as irons, kettles, and toasters, but electrical washers and wringers, wash boilers, vacuum cleaners, and the most recent types of electric cookers. Examples of modern electric fires, decorative lamps and fittings, contributed an additional element not only of interest, but of comfort and artistic completeness to an affair which was a pronounced success from every point of view. Demonstrations were carried out on "Magnet" cooking appliances throughout the exhibition.

BEARSTED (KENT).—An exhibition of electrical household appliances was held at the Village Hall on December 15th, 16th and 17th. The General Electric Co., Ltd., staged a comprehensive array of "Magnet" products in co-operation with Mr. Oswald Jones, electrical contractor, of Maidstone, and continuous demonstrations were given with cookers and other domestic appliances. The attendance throughout the exhibition was very satisfactory.

Social Events.—The staff and employés of the Birkdale District Electric Supply Co., Ltd., held their first annual dinner at the Scarisbrick Hotel recently, and afterwards adjourned to the Opera House, where seats had been booked for the play, "Big Business."

Members of the male staff of the Birmingham branch of the British Thomson-Houston Co., Ltd., spent a very pleasant evening on the occasion of their annual Christmas supper, which was held at the Woolpack Hotel, Birmingham, on December 17th. There was an attendance of about 30, over which Mr. C. E. Webb presided.

American Exports to South Africa.—The export of domestic electrical appliances from the United States to South Africa was dealt with recently by *Commerce Reports*. It is shown that while the exports of fans rose from $6,750 in 1924 to $10,620 in 1925, and motor-driven appliances from $2,465 to $3,180, the value of domestic heating and cooking devices supplied fell from $28,257 to $18,138.

Indian Electrical Imports.—The value of the imports of electrical machinery into India during September last is returned at £567,000, as compared with £344,000 in the corresponding month of last year.

Lighting and Power Notes.

Aylesbury.—LOAN.—The Town Council has applied for sanction to a loan of £3,000 for cookers and other electrical apparatus to be let on hire.

Barnstaple.—SUPPLY FOR LAUNDRY.—The Board of Guardians has decided to convert the laundry at the institution to electrical power, at an estimated cost of £821. It is stated that a saving of £148 a year will be effected by the use of electricity.

Barrow-in-Furness.—ELECTRICITY SUPPLY.—The General Purposes Committee on December 20th further considered reports from the Electricity Supply Sub-Committee on the question of obtaining an additional supply of electricity. The chairman of the Committee has had an interview with the Charcoal Iron Co., Ltd., and the Lancashire Ultramarine Co., Ltd., who possess the water rights of the River Leven, and he submitted letters from both companies giving amended terms upon which they would be prepared to reopen negotiations with regard to the proposed station at Backbarrow. The borough electrical engineer (Mr. Burnett) has prepared a report upon the question of increasing the plant at the Corporation's electricity works in Buccleuch Street, and interviews were held with the representatives of Messrs. Vickers, Ltd., with regard to a proposed increased reciprocal supply from them. A letter was received from Messrs. Thomas Wilkinson (Arnside), Ltd., who are applying for an Order to supply the whole of Westmorland, offering to give a supply of electricity in bulk to the Corporation from their proposed power station at Carnforth. It was decided to inform the company that the Corporation does not anticipate that it will require such a supply. The Committee has decided that a deputation shall be appointed to interview the Electricity Commissioners and request them to give their consent to the carrying out of the Backbarrow scheme, or, as an alternative, to the extension of the plant at the Buccleuch Street works, at an estimated cost of £60,000.

Bradford.—STREET LIGHTING.—The Corporation Electricity Department is engaged in the replacement of gas lighting on the main tramway routes by a system of 2,000 electric lights, these being erected on the tramway standards over 50 miles of roads. Nearly a quarter of the lamps have now been erected, and completion is expected in April.

Bury.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. J. G. Potts) for the year ended March 31st last shows a total income of £101,424, as compared with £90,563 in the preceding year. Working expenses amounted to £58,113, as against £54,693, leaving a gross profit of £43,311 (£36,239), to which was added revenue from other sources, making a total of £46,218 available. Capital charges absorbed £38,381, and there was a net surplus of £7,837, as compared with £2,121 in 1924-25. A contribution of £1,000 was made to the borough fund. The capital expenditure during the year amounted to £29,227, the bulk of which was spent on mains and services. The sales of electrical energy increased from 18,479,648 to 21,091,253 kWh, and the maximum supply demanded from 7,690 to 9,129 kW. The average price obtained per kWh fell from 1.175d. to 1.146d.

ELECTRICITY EXTENSIONS.—The Electricity Committee has decided to apply for sanction to the first portion of a scheme for the replacement of certain plant at the generating station, and has also recommended that extensions to the plant at Chamber Hall, estimated to cost £17,450, be carried out forthwith.

Chester.—LOAN.—The Town Council has decided to make application for sanction to borrow £5,000 to meet the cost of services for the connection of new consumers.

ELECTRICITY SUPPLY.—Proposals have been made by the Gwynedd Trust to the Corporation Electricity Committee that if steps were taken to exclude part of Tarvin and Tarporley from the area of the North Wales and South Cheshire Joint Electricity Authority, the Trust would be prepared to withdraw its Special Order in respect of the extended area. This means that the Corporation's application would not be opposed. The Committee has intimated its willingness to hold a joint conference with the Trust to discuss the matter. It has been suggested that the chairman should be a member of the Electricity Commission.

Continental.—RUSSIA.—A *Reuter* message from Leningrad states that the new power station at Volkhov was formally inaugurated on December 19th. The station has a capacity of 56,000 kW, and the cost was approximately £9,000,000. The electricity generated will be used for the various industries in Leningrad.

FRANCE.—The Syndicats Intercommunaux des Cantons de Bray-sur-Seine et de Donnemarie has placed contracts with the Société Energie Industrielle, of Paris, for a considerable extension of the electricity distribution system in the Department of Seine-et-Marne. The contract includes 80 miles of h.p. mains, 62½ miles of l.p. mains, and 65 transformer cabins. The Energie Industrielle Co. is also about to erect a transmission line, supported on ferro-concrete masts, between Nangis and Montereau to connect the general distribution system with the power station at Montereau.

Coventry.—LOAN.—The Electricity Committee is applying for sanction to a loan of £30,000 for mains.

Dorking.—INQUIRY.—Col. T. C. Ekin, on December 17th, held an inquiry into the applications of the Leatherhead and District Electricity Co., Ltd., and Edmundson's Electricity Corporation, Ltd., for Orders to supply electricity in the parishes of Betchworth, Buckland, Dorking Rural, and parts of the parishes of Wotton and Abinger. The objections received included one from local authorities, who drew attention to the maximum price of 1s. per kWh.

Fochabers.—NEW PLANT.—The engineer of this station, Mr. W. Sanderson, has installed a new storage battery of 480 amp.-hr. capacity, and a new generator and booster set is also being put down.

Girvan.—ELECTRICITY SUPPLY.—The Town Council has sealed a draft agreement with the Ayrshire Electricity Board for a supply of electricity to the borough.

Glazebury (Lancs.).—ELECTRICITY SUPPLY.—The Lancashire Electric Power Co. has obtained an Order authorising it to supply electricity in the district, and has approached Leigh Corporation for terms upon which it will give a supply.

Glossop.—PURCHASE OF UNDERTAKING.—The Town Council is considering the question of purchasing the local electricity and tramway undertaking of the Urban Electric Supply Co., Ltd.

Gravesend.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of £12,000 for mains, and £8,000 for services.

Holywell.—INAUGURATION OF SUPPLY.—An electricity supply for the district was inaugurated by the chairman of the Urban District Council on December 20th.

Kingussie.—ELECTRICITY SCHEME.—Consideration of the electric lighting scheme has been deferred pending a further communication from the Grampian Electricity Supply Co. regarding its proposed charge of £5 per lamp for street lighting.

Lichfield.—CONSULTING ENGINEER.—Mr. W. C. C. Hawtayne has been retained as consulting electrical engineer by the City Council for five years, at a fee of 50 guineas per annum, plus disbursements.

London.—BATTERSEA.—The Electricity Committee is applying for sanction to a loan of £45,000 for mains, services, and machinery.

BERMONDSEY.—The Electricity Committee is applying for sanction to the borrowing of £15,000 for mains, services, and meters.

Lyme Regis.—ELECTRICITY EXTENSIONS.—A special meeting of the Town Council is to be held shortly to consider a proposal to borrow a sum of over £18,000 for municipal works, including £16,065 for the electricity undertaking.

Raunds.—INQUIRY.—Sir William F. Marwood, of the Ministry of Transport, held an inquiry on December 17th relative to the refusal of the Urban District Council to allow the Rushden and District Electric Supply Co., Ltd., to erect overhead mains across the Raunds-Ringstead Road. For the company it was stated that it was proposed to cross the road with an 11,000-V line for the supply of electricity to Ringstead, Denford, and Thrapston, where an immediate service was required. The Council's objection was on the grounds of danger to the public.

Saffron Walden.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £1,309 for feeder mains.

Shap.—ELECTRICITY SUPPLY.—The Urban District Council has received a communication from Manchester Corporation, stating that it would be willing to consider the question of supplying electricity to the district if the Council would furnish full particulars of its requirements. The Council is to consider the matter at an early date.

Southend-on-Sea.—FAMBRIDGE SCHEME WITHDRAWN.—The Electricity Committee has decided to withdraw its recommendation to adopt Mr. Rider's scheme for the erection of a power station at Fambridge, and proposes to place before the Council a scheme for the linking-up of the three local generating stations, thus mobilising the spare plant and giving the Council time to consider the question of a steam power station which will be acceptable to the Electricity Commissioners.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following:—The Leicestershire and Warwickshire Electric Power Co., authorising it to supply electricity in the rural district of Monks Kirby, and certain parts of the rural districts of Foleshill, Meriden, Nuneaton, Rugby, and Warwick; Messrs. C. J. Cooper & W. C. Hands, authorising them to supply in the urban district of Bicester.

Tobermory.—INAUGURATION OF SUPPLY.—An electricity supply for the town was formally inaugurated on December 22nd. Power is obtained by damming a river, and the plant includes a 42-h.p., 220-V dynamo. The cost of the scheme was approximately £5,000.

Tynemouth.—ELECTRICITY SUPPLY FOR DOCKS.—The Corporation Electricity Committee has arranged to give a supply of electricity to the Tyne Improvement Commissioners for their docks area, at an estimated cost of £6,300.

Wallingford.—ELECTRICITY SUPPLY.—The Rural District Council has agreed to the application of Abingdon Electric Supply Co., Ltd., for an Order to supply electricity to Didcot and Northbourne. The company has arranged a supply of electricity in bulk from the Oxford Electric Supply Co., Ltd., for distribution in Abingdon, Wantage, and other places, and it is proposed to supply electricity for lighting at 1s. per kWh and for power at 4d. per kWh in the winter and at 2½d. per kWh in the summer.

Walton-on-Thames. — PURCHASE OF UNDERTAKING. — The Urban District Council has applied to the Electricity Commissioners for sanction to a loan of £100,000 for the purchase of the local electricity undertaking of the Urban Electric Supply Co., Ltd.

West Ham.—NEW PLANT.—The Town Council has received consent to the extension of the generating station by the installation of one 50-cycle turbo-alternator, having a maximum continuous rating of 10,000 kW, a 60,000-lb. boiler, and the necessary auxiliary plant.

Tramway and Railway Notes.

Australia.—SYDNEY (N.S.W.).—*The Times* reports that the first underground section of the City Railway, from the Central Railway station, the terminus of the suburban and country train service, to Saint James' station in King Street, near the centre of the city, was opened on December 20th. One suburban line is already electrified and others are being prepared.

Blackpool.—NEW CARS.—The Corporation Tramways Committee has decided to purchase seven new double-deck tramcars and six new omnibuses, making a total of 150 tramcars and 14 'buses owned by the Corporation.

Bradford.—RAILLESS CARS.—The Corporation Estimates Sub-Committee on December 23rd adjourned for one month the question of the substitution of railless cars for the present tramway system on the Allerton section from Four Lane Ends to Sandy Lane.

Continental.—DENMARK.—A Danish private railway—the Amagerbanen—is making plans for electrification. The railway receives a certain subsidy from municipal and Government sources, and it is expected that during the next session of the Rigsdagen necessary legislation will be enacted to allow and provide for the electrification and for other improvements.—*Commerce Reports.*

HUNGARY.—According to *Commerce Reports*, a proposal by an English financial group to undertake the electrification of that part of the Hungarian State Railways running from Budapest to Esztergom on the Vienna route, 46 km. from Budapest, has been given favourable consideration by the Government. It is estimated that 55 electric locomotives would be required for the new service, at a total cost of 16,500,000 gold crowns. The additional equipment and generating plant will cost 260,000,000,000 paper crowns. The terms of the proposed contract provide that preference shall be given to Hungarian industrial products in installing the new equipment. Should the plans be carried to a successful conclusion, it is expected that work will be begun early in 1927, and that after completion, work will be undertaken on the electrification of the railway from Budapest to Hatvan, 69 km.

FRANCE.—The new main-line electric service between Paris and Vierzon of the Orleans Railway was formally inaugurated by the Minister of Public Works on December 22nd. The length of the route is approximately 128 miles, and it is the longest electrified section in France. *The Times* states that for the inaugural trip a train composed of seven coaches, drawn by a locomotive of 3,000 h.p., which is capable of a speed of 80 m.p.h., was used. There are 200 engines of 1,420-1,720 h.p. for ordinary passenger and goods trains, with a speed of 56 m.p.h. The suburban traffic is carried on by 80 motor coaches of 990 h.p. The total number of electric trains provided for is 400 per day. The power is furnished at 1,500 V d.c. and conveyed by more than 562 miles of overhead lines. The amount of coal to be saved by the electrification of this section is estimated at about 250,000 tons a year.

Crewe.—SIGNALLING BREAKDOWN.—Traffic on the main line of the L.M. & S. Railway was dislocated for four hours at Crewe on December 19th owing to a breakdown of the electric signalling apparatus. There are two electric signalling boxes at Crewe, and in one of these, which controls all trains entering Crewe from the south, the levers were thrown out of gear owing to a fused wire, which set fire to a portion of the plant. The rails immediately became locked.

London.—BOND STREET STATION.—The remodelling of the interior of Bond Street underground station (C.L.R.) is nearly completed. Passimeter booking booths and the latest electrical ticket-issuing machines will be installed.

Mansfield.—LIGHT RAILWAY ORDER.—The Minister of Transport has made the Mansfield and District Light Railways (Extensions, &c.) Order, 1926, authorising the construction of light railways in the urban district of Mansfield Woodhouse, and in the rural districts of Southwell and Skegby.

Middlesbrough.—TRACK RENEWALS.—At a meeting of the Corporation Tramways Committee on December 21th it was decided to continue the present tramway service to Linthorpe and to relay the tramway track in Linthorpe Road.

Stoke-on-Trent.—MOTOR-OMNIBUS LICENCES.—The *Birmingham Post* states that a recommendation by the Watch Committee to grant four additional omnibus licences to the Potteries Electric Tramway Co. on the Victoria Road, Hanley, and Longton route, provided that the company relinquished its tramcars, removed the tramway track, and restored the road, was defeated at a recent meeting of the City Council. The matter had been before the Council on a former occasion, when it was decided to grant the licences, but to hold over the matter pending the result of negotiations with the company with a view to the Corporation purchasing its undertaking. It was stated that negotiations had broken down.

Wharfedale (Yorks.).—SUGGESTED RAILWAY ELECTRIFICATION.—The *Yorkshire Post* reports that an interesting suggestion is put forward by Mr. F. S. Eckersley, clerk to Ilkley Urban District Council, for the electrification of the railways from Leeds and Bradford into Wharfedale. For a long time there have been complaints that the services are inconvenient and do not meet local requirements. Mr. Eckersley's contention is that by electrification a better train service would be secured, and the various local authorities through whose districts the railway passes are being asked to state their views.

Telegraph and Telephone Notes.

Australia.—"BEAM" RADIO-TELEGRAPHY.—None of the reports of the Australian "beam" service tests which have appeared in the Press have been authorised by the Marconi Company. However, the company states that the preliminary tests so far carried out have been highly successful, and it anticipates that the stations will be handed over to the General Post Office for the official tests early in the New Year.

Honduras.—NEW RADIO-TELEGRAPH STATION.—Work has been recommenced on the erection of the high-powered wireless station at Puerto Castilla, which will eventually replace the obsolete one now in use. With the opening of the new station, messages may be received and sent direct, if necessary, to New Orleans, Tegucigalpa, Habana, Puerto Cortes, and other distant destinations, says *Commerce Reports*. However, as heretofore, messages will normally be relayed through the station at Téla, a supervisory centre in Honduras.

New Pacific Cable.—FAULT REPORTED.—Almost simultaneously with the holding of festivities in celebration of the completion of the duplication of the Pacific telegraph cable, comes news from Australia that the section of the new cable between Fanning Island and Suva (Fiji) revealed intermittent continuity shortly after completion. This subsequently ceased and the cable is being operated at full capacity, showing the normal electrical condition under test. The necessity of removing the fault is being discussed by Messrs. Siemens Bros., the contractors. Meanwhile the cable ship *Faraday* is proceeding to Suva in readiness to remove the fault and verify the tests already taken. The fault is 184 miles from Fanning Island. The nearest splice is thirty miles away.

Russia.—TELEGRAPH AND TELEPHONE SERVICES.—*Reuter's* agency has received a statement from M. Smirnov, People's Commissar for Posts and Telegraphs of the U.S.S.R., who has lately been in England. He states, *inter alia*:—

TELEPHONES.—"Telephony has developed considerably during the last few years, although there is still a very great shortage of connections in the U.S.S.R. During the present year the Moscow system has been extended; four automatic stations with an initial capacity of 40,000 'members' are now being constructed. The work is being carried out by the Low-Tension Trust, and a programme has been drawn up for a period of five years, which will supply the most necessary needs of the population at a cost of 150,000,000 roubles, but an endeavour will be made to raise the necessary capital in order to put the work on a more extensive footing. The Telephone Department is very profitable, and a considerable proportion of the required capital is furnished by the profit made in this Department. The rest is obtained

from the profit on the postal system and by means of loans. During the last three years the extent of our telephone lines has increased by 40 per cent.; last summer the Moscow-Rostov and Moscow-Kiev lines were completed, whilst in 1927 a Rostov-Tiflis line will be constructed. We shall thus have connection between Leningrad-Moscow-Rostov-Tiflis, a total of 2,000 kilometres. Our international telephone communications are also developing very successfully."

TELEGRAPHS.—"As regards the telegraph system, it is still insufficient for our needs. We are extending the system so far as is possible with the means at our disposal; during 1926 a new telegraph station was erected in Moscow, which will be the second largest building in Moscow, and it will also house the international telegraph station."

RADIO.—"I should like to express our thanks to the management of the Marconi Company for the assistance it gave us in our investigation of the radio system of Great Britain. We are full of admiration for the remarkably fine work done by the Marconi Company; it struck us as some of the best we have seen anywhere. We should also like to express our thanks to the Postmaster-General, Sir William Mitchell-Thomson, by whose courtesy we were enabled to view the telegraph and other institutions of the Post Office. Our short stay in Great Britain has furnished us with exceedingly valuable material which we hope to make good use of on our return to the U.S.S.R."

The Telephone Service.—LONDON.—It is announced officially by the Controller's Office of the London Telephone Service that there are now 515,340 telephones in the London area. Inland trunk telephone calls during August (the latest month for which figures are available) numbered 7,495,096, an increase of 701,576, or 10.3 per cent., over the figure for the corresponding month last year. Calls made during the month to the Continent numbered 21,024, and those from the Continent 23,564, representing increases of 4,505 and 3,004 respectively over last year's figures.

NEW AUTOMATIC EXCHANGE.—A further addition to the telephone network in the Portsmouth area, inaugurated in 1916, has been completed for the Post Office by the cutting into service of a satellite exchange at Cosham village. The new automatic equipment was carried out by Automatic Telephone Manufacturing Co., Ltd. The present capacity is 180 lines, with provision for immediate expansion to 200 lines, the equipment comprising two (Strowger) rotary line-switch units equipped with guarded homing-type rotary line-switches, mounted as usual on swinging gates to facilitate inspection and adjustment. On the other side of the units are mounted the final selectors, auto-to-auto repeaters, test and offering distributor and auxiliary equipment for 2-party line service. The system, as originally planned, was four-digit, group selectors being located at the main Portsmouth exchange. An additional digit has, however, been added, and accommodation for the third group selectors is being provided at Cosham. Of the 180 initial lines, 75 are allocated to subscribers, 90 to p.b.x., and 15 to coin-box lines.

Transatlantic Telephony.—PROPOSED RADIO SERVICE.—It was recently stated by officials of the American Telephone and Telegraph Company that they expected to announce in the near future a definite date for the opening of a regular transatlantic wireless telephone service. For some time past the company, in conjunction with the British Post Office, has been experimenting with wireless telephony, and regular conversations have been taking place across the Atlantic at week-ends.—*Reuter* (New York).

Radio Notes.

Australia.—INVESTIGATION COMMISSION.—The Commonwealth has appointed a Royal Commission to investigate broadcasting, says the *Financial Times*. It is suggested that there will be alterations in policy and practice. The Commission is to work on much the same lines as the British Investigation Commission.

France.—CONTROL PLAN.—It is reported that the French Commerce Minister, M. Bokanowski, is seriously considering the advisability of issuing a decree shortly which will place all broadcasting in the hands of the State. According to the *Financial Times*, the postal and telegraph workers have met M. Bokanowski and urged him to do this so that the broadcasting business may become a department of the French Post Office, employing only postal servants. The Commerce Minister apparently favours this idea.

Germany.—The new station at Langenburg, near Elberfeld, in the Rhineland, recently commenced testing on a wave of about 470 m. It is expected that it will commence regular transmission early in the new year on a wavelength of 468.8 m. It is said to be the most powerful station in Europe; its power is said to be 22 kW, and rumour has it that this figure will be increased to 60 kW in the near future. The studios are situated at Cologne and Dusseldorf.

India.—WIRELESS IN CEYLON.—Our Indian correspondent states that another step is to be taken to popularise broadcasting in Ceylon. Government has recognised that it is impossible to provide good programmes constantly without some financial expenditure. The Postmaster-General has reported that the general impression in the trade and wireless circles is that progress in broadcasting is retarded because the programmes are not sufficiently varied. The chief engineer, Telegraph Service, recommends that the sum of Rs.300 per annum allowed for entertaining artistes should be increased to Rs.3,000 per annum for the organisation of programmes. There are at present 335 licence-holders, and the revenue collected from licence fees during the year amounted to Rs.3,350. With better programmes it is anticipated that the number of licences will be greatly increased. Government proposes to authorise the Postmaster-General to incur an expenditure not exceeding Rs.3,000 this financial year, on the understanding that the whole position will be reviewed again 12 months hence.

Lighthouses and Lightships.—AN APPEAL.—An appeal to their readers is being made by the *Daily News* and *Star* to equip all British lighthouses and lightships with wireless receiving sets. Twelve have been equipped (two lighthouses and 10 lightships); 25 lighthouses and 45 lightships are "silent." About £1,200 is required, and it is hoped that the response will be immediate and generous. Any town or village can "adopt" a local light station, and thus express appreciation of the unselfish men on "point duty" on our sea highways.

Russia. — BROADCASTING DEVELOPMENTS. — The Soviet Government contemplates big developments in broadcasting, some of which were recently explained to the *Daily Telegraph* by M. I. N. Smirnoff, People's Commissar for Posts and Telegraphs of the U.S.S.R., who has been in this country studying our methods, not only of broadcasting, but also of conducting the telegraph and telephone services. M. Smirnoff stated that there were in Russia about sixty local stations, in addition to the Moscow station. In two months' time a much more powerful station, with a radius of 2,000 miles, would be opened at Moscow. Broadcasting was being used for three purposes: For supplying the population with newspaper information, for announcing Government decrees and instructions, and for transmitting lectures, music, and the drama, and at many of the street corners of Moscow there were loud-speakers, beneath which crowds gathered, even in winter. M. Smirnoff intended to return to Russia on December 21st.

Reuter's agency has received the following statement by M. Smirnoff: "The Commission which accompanied me on my visit to Great Britain consisted of Professors Bronch-Bruevich and Rozhansky, engineers Shorin and Vassiliev, and the president of the Low-Tension Electrical Trust, M. Zhukov. It came here at the recommendation of the late M. Krassin and the invitation of the Marconi Company, and its main object was to acquaint itself with the latest achievements in the domain of radio construction and broadcasting."

The New B.B.C.—SERVICE TRANSFERRED.—At midnight to-night (December 31st, 1926) the British Broadcasting Co., Ltd., will cease to be, and the British Broadcasting Corporation (Inc.), will come into being. Probably coinciding with the change-over, a campaign against "pirate" owners of receiving apparatus is to be commenced. The Post Office authorities have secured about 500 convictions of unlicensed listeners since the passing of the Act of 1925. There are now over 2,130,000 holders of receiving licences in this country.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Aberdeen.—Town Council. Electric lighting and heating work in connection with the erection of a pavilion, shops, dance hall, restaurant, and lounge to lodge. Director of Housing, Town House, Aberdeen.

Argentina.—BUENOS AIRES.—February 24th. Department of Navigation and Ports. Three 10-ton electric shunting locomotives (Diesel type). (A.X. 4016.)*

Askern (near Doncaster).—January 18th. Electric light installation at Sutton Road new school. Education Department, West Riding County Hall, Wakefield.

Australia.—SYDNEY.—January 26th. New South Wales Government Railways. Electric railway car equipments, consisting of motors, control equipment, air compressors, pantographs and accessories. (Spec. 1065). (A.X. 3810.)*

Brighton.—January 7th. Tramways Department. 125 tons B.S. No. 7 steel girder tram rails. Forms of tender from the Tramways Engineer, Lewes Road, Brighton.

Burnley.—January 27th. Tramways and Omnibus Department. General stores for 12 months. Schedules from the General Manager, Queensgate Depôt, Burnley.

Canada.—GREAT FALLS.—January 17th. Manitoba Power Co., Ltd. Three 7,000-kVA single-phase oil-insulated indoor-type transformers for Lac du Bonnet, Manitoba. (B.X. 3118.)*

Dublin.—January 4th. Electricity Department. One surface condenser, with auxiliary plant. (December 17th.)

Ecuador.—QUITO.—Municipal Council. 3,000-h.p. hydro-electric plant for which water power with a fall of 42 metres is available, to be owned and worked by the city authorities. A second installation of similar capacity, for the port and city of Guayaquil, is also contemplated.—*Reuter's Trade Service* (Quito).

Egypt.—CAIRO.—January 10th. Ministry of Public Works, Mechanical Department. Electrical generating plant for Giza. (B.X. 3079.)*

Fort William.—February 1st. North British Aluminium Co., Ltd. Water turbines (impulse type) and d.c. generators for the Lochaber water power scheme. (December 10th.)

Glasgow.—The Corporation Water Committee is inviting tenders for pumping plant for Possil Park pumping station.

Haverfordwest.—January 15th. Water Department. One vertical treble plunger pump (16,000 galls. per hour capacity) and one 50 b.h.p. (approx.) semi-Diesel oil engine. Particulars from the Water Engineer.

Huddersfield. — January 5th. Education Committee. Electric light installation, open-air schools, Woodhouse Hall. Borough architect, 26, Ramsden Street.

The Tramways Committee invites tenders for the supply of materials required in the reconstruction of portions of the track on the following sections to be carried out during the year, *viz.*: Manchester Road, Moldgreen, Bradley, King Street, and Outlane.

Hull. — January 20th. Electricity Committee. Two 12,500-kW turbo-alternators and condensing plant. (December 17th.)

India.—India Store Department. January 4th, 1927. 264,650 (approx.) copper bonds for track rails. (November 26th.)

January 21st. Circulating-water pumps, screens, and pump-house equipment, including delivery and erection in India. (December 10th.)

February 4th. 11 complete traction sub-stations and track-sectioning cabin equipments, including delivery and erection in India. (December 10th.)

January 11th. Bombay, Baroda and Central India Railway Co. Crude oil engine generator sets. Specification (10s.) from Mr. S. G. S. Young, Secretary, 91, Petty France, Westminster, S.W.1.

January 7th. South Indian Railway Co., Ltd. Overhead transmission line material and cables and water cranes. Specifications from The Secretary, 91, Petty France, S.W.1.

Liverpool.—January 19th. Electricity Supply Department. 250,000 tons best quality steam slack during the 12 months to March 31st, 1928. Forms from the City Electrical Engineer.

London.—ISLINGTON.—January 21st. Electricity Department. Twelve months' supply of electrical and engineers' stores, including cables, meters, electrical sundries, lamps, transformers, and cable terminal, service, network and fuse boxes, circuit breakers, &c. (December 10th.)

LONDON COUNTY COUNCIL.—January 10th. Electrical installation at the Frankham Street, Deptford, S.E., elementary school (approx. 153 points). (See this issue.)

STEPNEY.—January 18th. Board of Guardians. Electric goods lift at the St. George's-in-the-East Hospital. (See this issue.)

Manchester. — January 3rd. Electricity Committee. 33,000-V, 420-V, and 240-V switchgear. November 26th.)

January 11th. Tramways Committee. Electrolytic and cadmium copper trolley wire. Particulars from the General Manager and Chief Engineer.

New Zealand.—WELLINGTON.—Public Works Department. February 15th. Transformers for Waikato. (B.X. 2985.)*

February 14th. Government Railways. Switchgear, armoured cable and accessories, motor-generator sets, filament lamps and reflectors. (B.X. 3078.)*

DUNEDIN.—February 19th. City Corporation Gas Department. One motor-generator with control board and accessories. (B.X. 3095.)*

Romford.—January 10th. Board of Guardians. Intercommunicating telephone installation. (See this issue.)

Salford.—January 8th. City Council. Electrical wiring of premises, 143 and 147, Regent Street. Specifications from Medical Officer of Health, 143, Regent Road.

South Africa. — PRETORIA. — February 3rd. Municipal Council. E.h.p. cable and accessories, switches and cut-outs. (B.X. 3097.)*

JOHANNESBURG.—January 20th. Municipal Council. Supply of electric lamps. (B.X. 3112.)*

Stoke-on-Trent.—February 8th. Stoke and Wolstanton Union. Alterations and additions to the central-heating and hot-water services at the London Road Institution. The work includes large calorifiers, two electric generating sets, pumps, &c. Specification from Mr. T. Wood, clerk to the Guardians, Union Offices, Stoke-on-Trent.

Torquay.—Electricity Department. Railway siding and coal-handling scheme for Newton Abbot power station. Construction of elevated railway siding upon reinforced concrete gantry; one rotary wagon tipper; one railway wagon weighbridge with weighhouse; electric capstan and fair leads; coal-conveying plant; one 1,000-ton concrete storage bunker. Forms of tender, Mr. H. F. G. Woods, Electricity Offices, Upton Valley, Torquay.

Uruguay.—MONTEVIDEO.—February 18th. State Electricity Works. 65,000 kg. unvarnished black iron wire and 10,000 kg. g.i. wire. (A.X. 4019.)*

February 11th. 37,500 electric filament lamps. (B.X. 3117.)*

February 15th. 55,500 iron pieces (angles, ties, bolts, &c.) for overhead lines. (A.X. 4018.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnes.—Urban District Council. Accepted:—

Boiler-house plant.—Stirling Boiler Co.

Burton-on-Trent.—Town Council. Accepted:—

Extending the South Derbyshire mains to Woodville (£19,829).—Johnson and Phillips, Ltd.

Cape Town.—Electricity Committee. Accepted:—

20 tons hard-drawn bare copper wire (£1,680).—Associated Engineers Co., Ltd.
Cables and boxes (£542).—British Insulated Cables, Ltd.
Switch panel (£144).—Albert Vaux, Ltd.
100 fuses (£200).—Saaler & Franks, Ltd.

Carlisle.—Electricity Committee. Accepted:—

Central wiring (£104).—British Insulated Cables, Ltd.
Pipe covering (£428).—Sutcliffe Bros. & Bryce, Ltd.

Croydon.—Tramways Committee. Recommended:—

10 car bodies (£15,800), 10 trucks (£2,520).—Hurst, Nelson & Co., Ltd.
10 sets brakes (£550).—Electro-Mechanical Brake Co., Ltd.
10 sets electrical equipment (£8,430).—British Thomson-Houston Co., Ltd.

Hamilton.—Town Council. Accepted:—

Installation of electric light at "all-electric" houses.—Mr. R. J. Sinclair.

Huddersfield.—Town Council. Accepted:—

5,000-kW turbo-alternator, with condenser.—English Electric Co., Ltd.

Government Contracts.—The following contracts were placed by various Government departments during November:—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).

Motor-alternators.—Newton Bros. (Derby), Ltd.
Amplifiers.—Plessey Co. (1925), Ltd.
Battery gear.—Chloride Electrical Storage Co., Ltd.
W/t boards.—Whipp & Bourne, Ltd.; W. McGeoch & Co., Ltd.; Veritys, Ltd.; Park Royal Engineering Co., Ltd.
Boilers.—J. Thompson (Wolverhampton), Ltd.; Yarrow & Co., Ltd.; Cochran & Co. (Annan), Ltd.
Electric cable and boxes.—W. T. Henley's Telegraph Works Co., Ltd.
Electric cables.—Standard Telephones and Cables, Ltd.; General Electric Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Electrically-driven capstans.—T. Broadbent & Sons, Ltd.; Cowans, Sheldon & Co., Ltd.
Compressors.—Reavell & Co., Ltd.
Electric Goliath crane.—T. Smith & Sons (Rodley), Ltd.
Overhead electric cranes.—S. Butler & Co., Ltd.; Marshall, Fleming and Co., Ltd.
Electric lamp fittings.—Hawkers, Ltd.
Motor-generators.—Small Electric Motors, Ltd.
Electric light installation.—Johnson & Phillips, Ltd.
Junction boxes.—Baseby, Sadler & Co., Ltd.
Combined ohmmeters and generators.—Record Electrical Co., Ltd.
Electric bakery plant.—General Electric Co., Ltd.
Power supply switchboards and spares.—General Electric Co., Ltd.
Switches and indicators.—W. McGeoch & Co., Ltd.; Whipp & Bourne, Ltd.; Plessey Co. (1925), Ltd.
Electric winches.—Harfield & Co., Ltd.

WAR OFFICE.

Electric cable.—W. T. Glover & Co., Ltd.
Inert cells.—General Electric Co., Ltd.
Electric light fittings.—General Electric Co., Ltd.
Laryngaphone headsets.—Telephone Manufacturing Co., Ltd.
Motor (50 b.h.p.) and switchgear.—Laurence, Scott & Co., Ltd.

AIR MINISTRY.

Generator armatures.—Newton Bros. (Derby), Ltd.
Magnetos.—British Thomson-Houston Co., Ltd.
Transmitters, coils, aerial and grid leaks.—Gambrell Bros., Ltd.
Wavemeters.—H. W. Sullivan, Ltd.

POST OFFICE.

Telephone apparatus.—Standard Telephones and Cables, Ltd.
Testing, protective and miscellaneous apparatus.—Power Equipment Co., Ltd.; T. Watson.
Leclanché battery boxes.—Siemens Bros. & Co., Ltd.
Cables (various).—Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.
Joint box castings.—Ladywood Ironworks, Ltd.
Conduit.—Eureka Conduit and Fittings Co.; Longmore Bros.; J. McDougall, Ltd.
Electric lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Switches.—H. Incledon & Co., Ltd.
Electric battery trucks.—W. Goodyear & Sons, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; F. Smith & Co.
Leclanché zinc rods.—Locke; W. W. & R. Johnson & Sons, Ltd.
Telephone exchange equipment.—St. Marychurch (Torquay): Automatic Telephone Manufacturing Co., Ltd.; Plymouth Corporation, Vickers, Ltd. (Sheffield) Southend-on-Sea Borough Council, Parkinson Stove Co., Ltd. (Birmingham), and Sheffield Corporation: Relay Automatic Telephone Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cable.—W. T. Henley's Telegraph Works Co., Ltd.
Compressor set.—Reavell & Co., Ltd.
Fans and regulators.—Metro-Vick Supplies, Ltd.
Generating plant.—Belliss & Morcom, Ltd.
Insulators.—Doulton & Co., Ltd.
Lux cells.—Chloride Electrical Storage Co., Ltd.
Signalling material.—Tyer & Co., Ltd.
Telegraph line materials.—Bullers, Ltd.
Telegraph poles.—J. Spencer, Ltd.
Telephones, &c.—Peel-Conner Telephone Works; Ericsson Telephones, Ltd.
Telegraph ironwork, &c.—Siemens Bros. & Co., Ltd.
Train lighting equipment.—J. Stone & Co., Ltd.
Wireless apparatus.—Radio Communication Co., Ltd.
X-ray equipment.—Newton & Wright, Ltd.

Hamilton.—Housing Committee. Accepted:—
Electric lighting installation at the all-electric houses.—R. J. Sinclair, Glasgow.

London. — London and North-Eastern Railway Co. (Southern Section). Accepted :—
Siemens gasfilled and vacuum train-lighting lamps for 12 months.—Siemens and English Electric Lamp Co., Ltd.

SOUTHERN RAILWAY CO.—An important contract for electric railway equipment, valued at over £600,000, has been awarded by the company to the Metropolitan-Vickers Electrical Co., Ltd. Some details of this appear in our "Business Notes."

STEPNEY.—Electricity Supply Committee. Accepted :—
3¾ tons solder (£439).—H. B. Barnard & Sons.
2¼ tons sheet lead (£105).—G. Farmiloe & Sons, Ltd.

Coal for the electricity undertaking :—
150/600 tons D.S. nuts (55s. ton); 100/150 tons stock slack (28s. 11d. ton); 100/150 tons nutty slack (52s. ton); 270 tons ditto (67s. 6d. ton).—E. Foster & Co. 100 tons nutty slack (56s. ton); 91 tons ditto (66s. ton); 300 tons rough slack (62s. ton); 1,000 tons washed nuts (65s. ton); 1,000 tons nuts and small (60s. ton); 1,500 tons brown nuts (50s. ton).—W. Cory & Son, Ltd. 200 tons brown nuts (65s. ton).—J. Budd, Ltd. 200 tons ditto (65s. ton).—J. Hudson and Co., Ltd.

BATTERSEA.—General Purposes Committee. Accepted :—
Electric organ-blowing plant at Town Hall (£160).—Wm. Hall, Son and Norman & Beard, Ltd.

Electricity Committee. Accepted :—
1,000-kW convertor (£3,850).—General Electric Co., Ltd.
Suction and screening pits (£5,000).—Foundation Co., Ltd.

LAMBETH.—Board of Guardians. Accepted :—
"Cosmos" vacuum metal-filament, gasfilled, and carbon lamps for 12 months.—Metro-Vick Supplies, Ltd.

Hornsey.—Electricity Committee. Recommended:—
Year's supply of meters at existing prices.—Reason Manufacturing Co., Ltd.; Ferranti, Ltd.; Chamberlain & Hookham, Ltd.; and Venner Time Switches, Ltd.

Newport (Mon.).—Electricity Committee. Accepted:—
Construction of cable pits and ductways on Newport Bridge and approaches.—W. H. Smith.

Sittingbourne.—The Sittingbourne and Milton Regis Joint Hospital Board. Accepted :—
Installation of an electricity plant at the hospital :—
20-kW vertical engine (£1,088).—Campbell Gas Engine Co., Ltd.
Dynamo, booster, main switchboard, &c. (£453).—J. H. Holmes & Co., Ltd.
Wiring (£821).—Brunswick Engineering Co., Ltd.
Accumulators (£345).—Alton Battery Co.

Stonehouse, Lanarkshire.—
Electrical work at the new operating theatre and X-ray block at the County Sanatorium.—Telford, Grier & Mackay, Ltd., Glasgow.

Tynemouth.—Electricity Committee. Accepted:—
Cables (£2,170).—Macintosh Cable Co., Ltd.; (£136), Standard Telephones and Cables, Ltd.
Transformer (£144).—C. A. Parsons & Co., Ltd.

Watford.—Rural Council. Accepted:—
Installing electric light at 20 cottages at Herne Road (£160).—Mr. J. W. Russell.

Woodford.—Urban Council. Accepted:—
Installing electric light at the Council offices and fire station (£129).—County of London Electric Supply Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, December 31st. 39, Victoria Street, S.W. 7.30 p.m. Questions and General Technical and Practical Discussions.
Friday, January 7th. "Distortion in Heat-treated Case-hardened Carbon Steels." Mr. P. J. Haler.

Physical Society and Optical Society.—Tuesday, Wednesday, and Thursday, January 4th, 5th, and 6th. Imperial College of Science, South Kensington, S.W. From 3 to 6 p.m. and 7 to 10 p.m. Annual exhibition of electrical, optical ,and other physical apparatus.

National Association of Supervising Electricians.—Tuesday, January 4th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "The Transverter." Mr. W. E. Highfield.

Royal Society of Arts.—Wednesday, January 5th. John Street, Adelphi. 3 p.m. "The Story of a Wireless Valve." Professor C. R. Darling. (Juvenile Lecture.)

Institution of Electrical Engineers.—Thursday, January 6th. London. 6 p.m. "Electrical Equipment of Track on the Underground Railways of London." Mr. A. R. Cooper.

(Wireless Section).—Wednesday, January 5th. London. 6 p.m. "The Acoustic Problems of Microphones and Loud Speakers." Mr. G. H. Nash.

(South-Midland Centre).—Friday, January 7th. Engineering and Scientific Club, Queen Street, Wolverhampton. 7 p.m. "Electrical Research." Mr. W. Wilson.

(North-Western Students' Section).—Tuesday, January 4th. Milton Hall, Deansgate, Manchester. 7.30 p.m. "A Review of Domestic Load Matters." Mr. W. J. Forster.

Edinburgh Electrical Society.—Friday, January 7th. Royal Scottish Society of Art, 117, George Street. 8 p.m. Social and dance.

Institution of Fuel Economy Engineers.—Friday, January 7th. Royal Society of Arts, John Street, W.C.2. 6 p.m. "Utilisation of Low-grade Fuels for Steam Generation." Mr. W. F. Goodrich.

Electrical Power Engineers' Association (Southern Division).—Friday, January 7th. Institution of Electrical Engineers, London. 7 p.m. "Condensing Plant." Mr. J. N. Waite.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, January 8th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Collieries and Public Supply at Newport." Mr. T. S. Thomas.

(Western Sub-Branch).—Saturday, January 8th. 60, Wind Street, Swansea. Informal discussion on "Chief Electrical Inspector's Report, 1925-26." Mr. J. A. B. Horsley, Electrical Inspector of Mines, will reply to the discussion.

Notes.

Electrical Association for Women.—A large party of the Birmingham Branch of the above Association recently visited the Birmingham headquarters of the British Thomson-Houston Co., Ltd., and inspected various electrical equipment manufactured by the firm. An interesting feature of the visit was a small historical section showing the development of domestic lighting from the primitive saucer-lamp of 600 B.C. to the gasfilled internally-frosted electric lamp. The visitors also heard a demonstration of the Rice-Kellog loud-speaker in the new B.T.-H. demonstration room, after which they were entertained to tea. The party was accompanied by Mrs. R. A. Chattock.

Tramway Accident Report.—We have received a copy of the report on the inquiry into the circumstances of the accident which occurred on the Darwen Corporation tramway system on September 20th, when a tramcar was derailed at the sharp curve at the foot of the gradient at Sudell Road. Two passengers were killed and the others injured. Hand and electric brakes were provided. It is held that the derailment was unquestionably due to the fact that the car reached the sharp curve completely out of control and travelling at a speed far too high to allow of any chance of the curve being negotiated. The motorman is held responsible for failing to exercise that extreme degree of caution which his experience as a motorman should have taught him was necessary in the exceptionally bad conditions which prevailed.

H-type Cables.—We have received from the Enfield Cable Works, Ltd., a very comprehensive treatise, in the form of a well-printed and covered booklet on the development and manufacture of the H-type cable for very-high-pressure working. It is explained that in the ordinary belted cable, due to the fact that the formation of air pockets cannot be entirely eliminated, ionisation occurs, which in time leads to the actual breakdown of the insulation. It follows that the belt insulation and also the padded interstices of the cable are responsible for more than a comparative proportion of the total dielectric losses, and the inside surfaces of the ordinary cable are subjected to potentials of large value. In the H-type cable these interstices are not subjected to any electrical fields or stresses; therefore the dielectric losses are only those obtaining in the insulation of the individual cores. The mathematical formulæ for the stresses in the old and new cables are laid out clearly, and the stress areas and leakage paths are well illustrated. In dealing with the thermal considerations and current loadings, it is shown that the heat lines in the case of the normal-type cable do not take a direct path to the lead sheath, with the result of increased heating of the dielectric. The subject of dielectric losses with reference to voltage and temperature is dealt with in a separate section of the publication. Dielectric resistance, it is shown, is not a criterion of the dielectric strength of the cable, and fails to indicate local or even distributed faults, such as occluded air, gases or foreign material between the insulation layers. A number of interesting curves are given showing the relationship between the cable power factor and dielectric loss, temperature, and pressure. The factory tests to which the H-cable is subjected are clearly outlined, and interesting information is given on the jointing of c.h.p. cables.

Proposed Electric Goods Railway.—The Parliamentary Bill, promoted by Beecham Estate & Pills, Ltd., to enable Covent Garden Market (London) to be removed from its present site to that of the old Foundling Hospital in Bloomsbury provides, amongst other things, for the construction of six short sections of electric railway to connect the market with the London, Midland and Scottish Railway Co.'s goods station at St. Pancras.

Waste Gas Utilisation.—The Staveley Coal and Iron Company has commenced the assembling of the parts of a second gas engine to be installed for the generation of electricity by using waste gas from the coke-ovens. It will be one of the largest of its kind in the world, says the *Financial Times*. A similar engine was installed last year and has given every satisfaction. The scheme for the generation of electricity at the Devonshire works of the company includes the installation of a third gas engine. The company owns three generating stations, and, besides supplying its collieries and works, provides electric light of several villages, including Staveley, Brimington, Clowne and Eckington, and also a bulk supply to the Corporation of Chesterfield.

Electricity in Belgium.—An article in *The Times Trade and Engineering Supplement* for December 18th on electrical development in Belgium—the European country in which the conditions most nearly correspond with those obtaining here—gives interesting particulars of the present position. Electricity is distributed in 1,223 towns and villages, containing over 78 per cent. of the population, by 120 companies (supplying 4,680,000 inhabitants), and 150 municipalities (supplying 1,460,000 people). The greater part of this development, it is stated, has taken place since the war.

Belgium possessed in 1913 436 miles of electric tramway lines, and 347 miles of light railways have now been electrified. None of the broad-gauge railways have been electrified. The capacity of the generating stations of the Union of Electric Supply Companies in 1913 was 131,000 kW; in 1925 it was 630,000 kW, and the sales had risen from 140 to 790 million kWh, whilst the high-pressure mains had increased from 700 to 6,850 km. and the low-pressure mains from 2,600 to 10,500 km. in length. Local interconnection of public and private generating stations has had good results; a group of power stations in the Liége area, formed in 1920, now comprises nine metallurgical works, ten collieries, one tramway company, and four public distributing services. The aggregate capacity of this group of stations (31 in number, as against ten in 1920) totals 140,000 kW, of which 55,000 kW is supplied by gas engines at blast furnaces and coke-oven batteries, 70,000 kW by steam turbines and steam engines, and 15,000 kW by hydraulic turbines. Exchanges of energy are effected by means of a common main 90 km. (56 miles) long, connecting the generating stations with each other, through the intermediary of 32 sub-stations. The following table is of interest:—

	Generating capacity. (kW.)	Production in 1925. (kWh.)
Tramways	20,695	58,932,000
Coke works and collieries ...	273,013	552,448,000
Metallurgical works	182,886	579,446,000
Quarries	17,475	33,305,000
Other industries	67,780	159,315,000
Municipalities	69,338	101,017,000
Union of Supply Companies	630,000	790,000,000
Total	1,261,187	2,274,463,000

Belgium's total consumption of electricity in 1925 was 2,275,000,000 kWh—just under 292 kWh per head. Private and municipal distributing services furnished in the same year 891,000,000 kWh, or 114 kWh per head of the total population, which compares with 125 kWh per head for this country, as stated by the Electricity Commissioners (we have no reliable data of the output of private generating stations, but our total consumption has been estimated at 220 kWh). Belgium has but little water-power, but it is proposed to harness certain rivers, which will provide 350 million kWh per annum.

For domestic purposes, apart from lighting, electricity has not yet come into common use. In home industries, especially brush-making, the advance is more pronounced, and it is becoming clear that there is great scope for a revival in the production of highly-finished articles by individual craftsmen, thanks to an extended use of electrically-driven machine tools. Complete electrification has so far been carried out only in a comparatively small number of steel rolling mills, engineering works, wool-spinning and weaving mills, quarries, and coke works. In coal-mining especially a more general adoption of electrical energy would appear, finance permitting, both feasible and advisable.

Agriculture has been quick to avail itself of the opportunities offered by the extension of electrical distribution to rural districts. The Belgian agriculturist is keenly alive to the aid which electrical energy can afford him, and outlying farms are clamouring for facilities. In many cases, however, the cost of establishing a connection would be prohibitive with the tariffs at present ruling.

Electrical energy is being supplied to the public at low prices. In present circumstances the price works out, on the average, to the equivalent of about 2d. per unit for lighting, and 1d. per unit for other purposes. At these prices, less than half the pre-war rates, distributors cannot, as a rule, adequately provide for depreciation and capital redemption. It seems safe to predict that in due course the formula governing the companies' charges will be amended and prices raised, although a complete reversion to pre-war standards should not be necessary.

Appointments Vacant.—Borough electrical engineer for the Harrogate Corporation Electricity Department. Sales engineer for the Electricity Distribution of North Wales and District, Ltd. Chief engineer for the Government of Ceylon in connection with the hydro-electric scheme (£2,000). Shift engineer (£450) for the Government of Nigeria Public Works Department. Resident engineer as clerk of works (£800) for the Portishead generating station of the Bristol Corporation. (See our advertisement pages to-day.)

Tramcars versus 'Buses.—At the Plymouth Rotary Club on December 16th, Mr. H. P. Stokes, manager, Plymouth Corporation Tramways Department, addressed the members on street passenger transport, and vigorously defended the tramcar as a means of passenger transport. Tramways, he said, maintained practically 80 per cent. of the main roads in the larger towns of the country, yet no other user of that portion of the road contributed a farthing to it. A recent census of the traffic on the main roads showed that 82 per cent. travelled on the tramway track, and the excessive use of this track by other road users was causing continually-increasing cost to the tramway departments. As a feeder to an existing tramway system, and as the means of linking up thinly-populated areas, there was no vehicle at the present time which could compare with the motor-'bus, but in comparison with the tramcar it had never stood on a strictly competitive basis in so far as its obligations to the taxpayer in general were concerned. It was not the tramway systems, but tramway legislation, which was obsolete. In one case a small town had had to spend £4,500 to promote a Parliamentary Bill in order to run six small 'buses, whereas any private person could put them on the road by taking out only the requisite licence.

Capacity and Frequency Measurement by Means of the Neon Tube.—The following letter appeared in *Science* of December 10th:—"In the June 18th number of *Science* there appeared an abstract by Professor Frederick Bedell and Herbert J. Reich describing the use of a neon tube oscillator for obtaining a time axis in the study of alternating current wave forms by means of the cathode-ray oscillograph. The oscillator consisted of a condenser which was charged at a constant rate through a saturated vacuum-tube rectifier and discharged periodically and automatically by a neon lamp shunted across the condenser. The method of controlling the frequency of discharge, *i.e.*, changing the rectifier plate current by adjusting the filament rheostat, suggested the possibility of using the plate current as a means of measuring the condenser capacity or the frequency of oscillation. An analysis of the circuit yields the following simple equation for the frequency in terms of the capacity, plate current and maximum and minimum discharge voltages of the neon tube: $f = (I_p - I_l)/(C_c + C_o)(V_{max} - V_{min})$ where C_o is made up of the neon tube capacity, wiring capacity and coupling capacity to the amplifier or 'phones, and I_l is the leakage current through the condenser and through the neon tube at the time of discharge. This expression seems to be checked very closely by experiment. With a preliminary set-up containing low-precision rheostats and meters, readings accurate to within one quarter of one per cent. have been obtained in measuring capacity and frequency. For capacity measurement the frequency is maintained constant by comparison with a standard tuning-fork oscillator. Improvement of the apparatus promises to yield a very simple method of measuring capacity with a degree of accuracy quite sufficient for all ordinary purposes.—HERBERT J. REICH, Cornell University."

Long Submarine Power Cables.—In our issue of October 8th (p. 577) we reproduced a note from a contemporary regarding three long 33,000-V cables laid under the Mississippi River. It was believed that these constituted a record. Now, however, we are informed by Messrs. Vlies & Benson, Ltd., that their principals, the Forges et Ateliers de Construction Electriques de Jeumont, have done better. Quite recently they supplied a submarine cable of the equipotential surface type with three .054 sq. in. cores for a pressure of 15,000 V, to be laid under the Bosphorus, in the vicinity of Constantinople. This cable was manufactured in a single length of 2,500 metres (the American cable was made in 2,500-ft. lengths), representing a total weight of 33 tons, and was immersed at an approximate depth of 100 metres without difficulty. The company had previously made a 50,000-V, 3-core, 0.147-sq.-in. submarine cable, for installation between Sweden and Denmark, in 900-metre lengths, the total length being 5.4 km. Messrs. Vlies & Benson, of Manchester, have sent us a pamphlet containing these and other particulars.

E.P.E.A. Dinner.—The fifth annual dinner of the West Wales Section (Western Division) of the Electrical Power Engineers' Association was held at the Hotel Metropole, Swansea, on December 16th, when Mr. W. Riches, A.M.I.E.E. (chairman of the Section), took the chair. In proposing "The President and the Association," Mr. J. W. Burr, M.I.E.E., Swansea, pointed out that, although the Association was only nine years old, it embraced practically the whole of the eligible members of the industry. Mr. A. J. Ostler, president of the Association, in responding, said that the E.P.E.A. had introduced into the supply industry that new spirit about which they had heard so much. The Association was working amicably with the National Joint Board and the District Joint Board, and an arbitration clause had been arranged that would prevent any sudden upheaval in the industry. The spirit generally that animated the Association was service to the industry and the community. Mr. Ostler then proposed "The Electricity Supply Industry." He supposed that the Electricity (Supply) Bill satisfied no one. However, he had been rather struck by a statement of Mr. Sloan, of the North-East Coast Companies, who had been a bitter opponent of the Bill, that it was now up to everybody to make the best of it. Col. Sinclair, in reply, thought that the Act was not going to do a great deal for the present, but that the possibilities of the future were very great. Sir Arthur Whitten Brown also responded. The chairman made a presentation, on behalf of the members of the Section, of a silver rose bowl to Mr. H. Yeldham, the Section treasurer, as a mark of appreciation of the way he had carried out the duties of that office. Mr. Yeldham suitably replied. A fishing outfit was presented to Mr. G. W. Essex in recognition of his services as assistant general secretary of the Association. Mr. Essex briefly acknowledged the gift.

The Yacht "Aloha."—What is claimed to be the largest Diesel-electric yacht in the world is the sailing craft *Aloha*, of Commodore Arthur Curtis James, which is equipped with three 175-kW Diesel-driven generators with directly-connected 50-kW exciters, and a 640-h.p. double-unit propelling motor. The driving scheme is similar to the Diesel-electric propelling installations found on larger vessels. The control of the propelling motor is effected either directly from the bridge or by signalling to the engine room. The exciters supply power for excitation of the electrical propelling machinery, and also to the auxiliary bus-bars serving the engine-room auxiliaries, engine-room ventilating blowers, cabin fans, cabin electric heaters, steering gear, and electrically-operated sail hoists. The control provides an arrangement for connecting any one of the main generators to the auxiliary supply when the load on that is large, as when operating the boat hoists and the windlass. The propelling machinery was a notable exhibit at the Marine Show in New York in November, 1925. The electrical equipment was supplied by the Westinghouse Electric & Manufacturing Co.

The Whitworth Society.—The fourth annual commemoration dinner of the above Society was held at the Holborn Restaurant, London, on December 21st, the anniversary of the birth of Sir Joseph Whitworth, Bart. The chair was taken by Dr. F. P. Purvis, and about 70 persons were present. Seven of the scholars appointed during the current year attended as guests, and some most interesting speeches were made. Mr. Thos. Sugden, London, was elected president for the next year, to take office at the summer meeting, which will be held in Derby in July, when it is proposed to place a wreath on the tomb of Sir Joseph Whitworth at Rowsley. There are now about 500 members on the roll of the Society, and about 250 copies of "The Whitworth Book" have already been sold. Application for purchase forms should be made to the Hon. Sec., Whitworth Society, c/o Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1.

The World's Electrical Development.—*Commerce Reports* has published the first of a series of six-monthly tables which gives estimates of the population of countries of the world, the number of homes, the number of electricity consumers, and the percentage of homes wired. The population of the United Kingdom is given as 44,169,000, the number of homes as 8,500,000, and the percentage of wired homes as 17.7. We reproduce below particulars of other countries from the table:

Country.	Population. Thousands.	Total number of houses. Thousands.	Percentage of homes wired.
Belgium	7,466	1,600	30.7
Czecho-Slovakia ...	13,611	3,500	20.0
Denmark	3,268	750	72.0
Esthonia	1,107	252	38.5
Finland	3,367	700	17.2
France	39,210	9,345	21.4
Germany	59,853	14,700	20.4
Greece	5,168	1,200	1.0
Latvia	1,503	233	34.2
Lithuania	2,293	259	9.3
Netherlands ...	6,865	800	50.0
Poland	27,558	3,293	12.1
Spain	21,347	3,650	27.4
Switzerland ...	3,880	415	96.5
Canada	8,788	1,873	62.3
Guatemala ...	2,454	32	27.1
Mexico	15,501	2,500	10.0
Argentina	8,699	1,200	26.7
Colombia	5,855	900	5.2
Ecuador	2,000	280	15.3
Paraguay	1,000	88	4.6
Uruguay	1,529	320	26.5
Japan	59,936	10,856	73.4
Australia	5,992	1,107	41.0
New Zealand ...	1,347	260	59.0
British South Africa	6,929	208	45.6
Egypt	13,551	300	18.0

An Electric Furnace Explosion.—The *Daily Dispatch* reports that the bottom of a large electric furnace burned through at the works of Messrs. Thomas Firth & Sons, Ltd., Sheffield, on December 22nd, causing an explosion. Five men had narrow escapes from injury. The molten metal burned through six electric cables and caused sparks to fly in all directions. The fire brigade, fortunately, overcame the fire without any actual personal injury. The furnace will be out of operation for some time.

Junior Institution of Engineers.—In a paper entitled "Progress Methods Employed in a Large Mass Production Motor Works," on December 17th, Mr. H. D. Glover described in detail the manner in which control was exercised over machines, materials, and labour in order to obtain prompt fulfilment of orders without the necessity of amassing stocks of rough material or finished parts.

Mr. Glover dealt with purchase sanctions, urge and record cards, storekeeping and shortage bulletins, service demands, works order cards and job cards, and other details. He also described the works bulletin board, a large affair setting out in tabular form all machines and plant arranged according to their shops. Against each machine were coloured cards giving particulars of the component parts with which the machine was capable of dealing, and also white cards indicating the work that was actually on the machine. The white cards, each representing a numbered job, were moved from place to place on the board as the work moved from one operation to another in the works. A tear-off portion of the works job card provided the necessary information to the operator of the board.

The complete system as described by Mr. Glover comprised in effect an efficient record of contracts for materials and means for getting them carried out to time, a constantly up-to-date index and register of work in the shops, and a method of permanent stocktaking.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Recently in the traffic office of the Cork Electric Tramways Co., Chief Inspector J. F. BOWE was presented with a gold watch and chain from the motormen and conductors on the occasion of his marriage.

Alderman J. ROTHWELL, J.P., the new mayor of Salford, vice-chairman of the Electricity Committee, has been presented by his colleagues with an inscribed reading lamp as a memento of his election as mayor.

The Harrogate Town Council has accepted the resignation of Mr. GEORGE WILKINSON, borough electrical engineer, but will retain him in a consultative capacity for three years with remuneration at 500 guineas per annum.

Mr. G. E. BAILEY, works manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, has been elected president of the Manchester District Engineering Trades Employers' Association for the second year.

Opposition was raised at the last meeting of the Newark Corporation to proposals to appoint an electrical engineer at a salary of £350 and to engage Mr. R. W. WILLIS as consulting engineer at a retaining fee of 100 guineas a year, plus expenses. The suggestion as to the resident engineer's appointment was opposed by Mr. S. A. Smyth upon the score that there is no immediate great demand for electricity by the principal firms in the borough. The mayor (Major Appleby) emphasised the consideration that the undertaking had to be made to pay and the proposals as to the appointments were agreed to.

Modern Transport states that Mr. JAMES DALRYMPLE, of Glasgow, was recently entertained to luncheon at the Arundel Hotel, London, by the Executive Council of the Municipal Tramways and Transport Association. Mr. R. L. Horsfield, the president, was in the chair, and the company included Sir Herbert Blain, Mr. A. L. C. Fell, Mr. J. K. Bruce, Mr. T. B. Goodyer, and other well-known tramwaymen. Mr. Dalrymple, whose resignation was accepted by the Glasgow Corporation at last week's meeting, leaves for South America on January 14th, and according to our contemporary he will first proceed to Sao Paulo to report on the city's transport system, and later to Montevideo, Buenos Aires, and Valparaiso for a similar purpose. The Glasgow Corporation has appointed a sub-committee to report on steps to be taken to fill the vacant managership.

Congratulations to Mr. WALTER LINDLEY-JONES, O.B.E., C.C., so well known in trade journal and other circles in London, upon the completion of 40 years' occupation of the editorial chair of our contemporary, the *Mercantile Guardian*. The staffs of that journal and its companion publication, the *Mercantile Year Book*, marked the occasion by entertaining him to lunch at the Liverpool Street Hotel on Friday last, and presenting him with a silver salver bearing the engraved signatures of all employés.

The Cheadle and Gatley Urban Council has fixed the salary of Mr. R. WILLIS, electrical engineer and manager, as a full-time official, at £600 per annum.

The *South African Engineer* states that during the absence in this country on leave of Mr. T. C. WOLLEY DOD, city electrical engineer of Pretoria, Mr. L. L. HORRELL is acting as city electrical engineer.

Obituary.—MR. F. OFFOR.—We desire to place on record our deep sympathy with Mr. George Offor, of Sydenham, who, as readers know, is the oldest surviving electrical pioneer—we believe he completes his century in 1927—on the death of the last of his sons, Frederic, which occurred last Sunday week at Teddington.

MISS H. A. ELLIS.—The death is announced of Miss H. A. Ellis, travelling supervisor of the Post Office telephones for the Potteries and Newcastle area of Staffordshire. She had been connected with telephone work for upwards of 30 years, and was for some years in charge of the Newcastle-under-Lyme office of the National Telephone Co.

MR. R. OSBORNE.—A Birmingham paper announces the death of Mr. Richard Osborne, lately telegraph superintendent at the Birmingham Post Office. He retired on pension when reaching the age limit in July last, after 44 years' service.

MR. J. ROOTHAAN.—We regret to learn of the death, which occurred on December 23rd, of Mr. J. Roothaan, of 19, Bolton Road, Chiswick, and of the British Electric Transformer Co., Ltd., Hayes, Middlesex.

MR. T. PYE.—The death took place, on December 24th, after only two days' illness, of Mr. Thomas Pye, a director of the firm of H. S. Tett & Co., Ltd., electrical engineers, of Faversham.

New Companies Registered.

Volta, Ltd. (218,286).—Private company. Registered December 17th. Capital, £25,000 in £1 shares. Objects: To acquire from Nya Elektriska Aktiebolaget Volta the goodwill of the business of dealers in electrical goods carried on in connection with the trade mark "Volta," No. 435,175, together with the assignment of the said trade mark. The subscribers (each with one share) are:—J. Scrivener, 36, Keswick Road, Putney, S.W.15, electrical engineer; G. E. Tong, 5, Gray's Inn Square, W.C.1, solicitor. The first directors are not named. Remuneration as fixed by the company. Secretary: L. Ellisdon. Solicitors: Bird and Bird, 5, Gray's Inn Square, W.C. Registered office: 36 and 38, Kingsway, W.C.2.

Eagle Valves, Ltd. (218,319).—Private company. Registered December 20th. Capital, £100 in £1 shares. Objects: To carry on the business of dealers in electric lamps, wireless valves and parts, &c. The subscribers (each with one share) are:—A. Fuchs, 21, Brunswick Square, W.C.1, merchant; T. Falkenfleig, 4, Lansdowne Place, W.C.1, merchant. A. Fechs is the first director and manager. Qualification, 2 shares. Registered office: 19, New House, Hatton Garden, E.C.1.

Joseph Tabbush & Co., Ltd. (218,333).—Private company. Registered December 20th. Capital, £100 in £1 shares. Objects: To carry on the business of wireless, radio and electrical engineers, manufacturers of and dealers in electrical apparatus, and valves used in wireless telegraphy and telephony, &c. The subscribers (each with one ordinary share) are:—J. Tabbush, 46, Upper Gloucester Place, N.W.1, merchant; Leah Tabbush, 46, Upper Gloucester Place, N.W.1. J. Tabbush is permanent managing director and chairman. Registered office: 11, Queen Victoria Street, E.C.4.

United Radio and Electrical Works, Ltd. (218,295).—Private company. Registered December 18th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, agents for and dealers in electrical machinery, plant, apparatus and appliances, including instruments, wires, lines, wireless valves, high- and low-tension batteries, generators, accumulators, &c. The subscribers (each with one share) are:—Florence H. Lee, 13, Broxholme Road, West Norwood, S.E.27, clerk; B. Atkinson, 115, Princess Road, Kennington, S.E.11, cashier. The first directors are to be appointed by the subscribers. Qualification, £10 shares. Solicitors: Rochester, Pusey & Co., 90, Cannon Street, E.C.4. Registered office: 90, Cannon Street, E.C.4.

Furse Wholesale, Ltd. (218,291).—Private company. Registered December 18th. Capital, £10,000 in £1 shares (5,000 7½ per cent. non-cumulative preference and 5,000 ordinary). Objects: To carry on the business of merchants, distributors and suppliers of and dealers in machinery, electrical engineers, suppliers of electricity, manufacturers of and dealers in electric railway and tramway, and electrical, magnetic, galvanic and other apparatus, telephones, telegraphs, wireless and other instruments, apparatus and requisites, &c. The subscribers (each with one ordinary share) are:—W. J. Furse, Edwalton, Nottingham, director of companies; W. F. Furse, Holm View, Victoria Embankment, Nottingham, electrical engineer. The first directors are W. F. Furse, H. J. Furse, and S. J. Furse. No qualification required. Solicitors: Goodall, Son and Flewitt, 12, Middle Pavement, Nottingham.

Official Returns of Electrical Companies.

Capel's Wholesale Wireless Co., Ltd.—Particulars filed of £2,000 debentures authorised December 7th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

General Battery Co., Ltd.—Debenture dated November 29th, 1926, to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. J. Wade, 188, Gray's Inn Road, W.C.

Welco Patents, Ltd.—E. Greenhill, of 7, Newhall Street, Birmingham, was appointed receiver on December 14th, 1926, under powers contained in debenture dated September 29th, 1923.

Burndept Wireless, Ltd.—Agreement dated November 19th (supplemental to charge dated May 4th, 1926), varying the terms of the original deed whereby the amount £100,000, secured by such original deed is reduced to not more than £50,000 as from November 30th, charged on freehold and leasehold properties at Blackheath and Willesden and the company's other assets, including uncalled capital. Holders: Coutts & Co., 440, Strand, W.C.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Bullers, Ltd.

The report for the year ended July 31st last states that considerable damage was inflicted upon the company by the industrial troubles during the year, and a trade revival could only be expected to alleviate or offset the adverse conditions of trade since August 1st. The profit for the year was £3,557; to this it is proposed to add £5,000 from the general reserve, and, with the amount brought forward, the sum available is £14,222. From this the preference dividend is to be paid and £5,807 transferred to the debenture sinking fund, leaving £915 to be carried forward. In the preceding year the ordinary shares received a dividend of 5 per cent., free of tax, out of a profit of £21,985. Mr. C. T. D. Burchell has been appointed to the board.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

Meetings of the debenture and note-holders were held on December 22nd, under the chairmanship of Sir Edwin Cornwall, Bt., the chairman appointed by the Court. The proposals outlined in our issue of December 17th (p. 1006) were approved after some discussion and criticism of the board. Briefly, the scheme provides for a moratorium of five years so far as the payment of dividends on the share capital is concerned, and the debenture and note capital is to be given a modified participation after the payment of interest on the 4 per cent. first mortgage debenture stock, according to the amount available. Funding certificates will be issued at the end of the five years in respect of interest in arrears.

French Companies.

The *Société pour l'Equipement Electrique des Véhicles* reports a net profit of 3,017,000 fr. for the past year, as compared with 2,705,000 fr. in the previous year, the dividend remaining at 10 per cent., as in 1924-25. The turnover again increased, particularly with regard to magnetos and dynamos, and further extensions of the works have been undertaken.

The *Compagnie Générale d'Electricité* of Paris reports net profits of 15,852,000 fr. for 1925-26, as compared with 13,444,000 fr. in the previous year. It is proposed to maintain the dividend at 70 fr. per share, which will apply to capital of 90,000,000 fr., as against 75,000,000 fr. in 1924-25. The report states that new workshops have been completed at Saint-Jean-de-Braye, near Orleans, and that the steam power station of the Marseilles Electricity Company (a subsidiary) at Cape Pinède is about to be modernised.

The *Société Sud-Electrique* reports that it obtained 14 new concessions in 1925-26 and placed 22 concessions in operation. The accounts show net profits of 2,807,000 fr., and the dividend is at the rate of 10 per cent.

The directors of the *Etablissements Paz et Silva* report net profits of 934,000 fr. for 1925-26, and are paying a dividend of 5 per cent.

The *Société Industrielle des Téléphones* reports that the works were well supplied with orders in 1925-26; the turnover and profits consequently increased, permitting of the payment of a similar dividend to that of the previous year (50 fr. per share). During the year the company completed the installation of the different manufactures at the new Clichy works, where business is constantly developing, and it is now entering upon a period of full activity. The submarine cable factory at Calais, which had remained idle since the manufacture of the Marseilles-Algiers cable, has recently resumed activity as a result of the receipt of small orders from the State and the French Cable Company. The accounts show net profits of 10,850,000 fr.

La Société des Etablissements Gaiffe-Gallot & Pilon, Paris, manufacturer of high-pressure electrical instruments and apparatus, is increasing its capital from 8 to 15 million francs.

German Companies.

The *Company for Electrical Undertakings*, Berlin, which is an investment concern, holds out the prospect of the payment of a dividend again at the rate of 10 per cent. for the past year.

The *German Atlantic Telegraph Company* has now finally approved a scheme of amalgamation with the German-Netherlands Telegraph Company, of Cologne, on the basis of an interchange of shares. A fresh increase in the share capital of the former has been decided upon to the extent of 840,000 marks for the purpose of the interchange.

The *South German Telephone Apparatus, Cable and Wire Works Co.*, Nuremberg, which is a subsidiary of the Felten and Guilleaume Company, reports net profits of 270,000 marks for 1925-26, as compared with 280,000 marks in the previous year, when a dividend at the rate of 8 per cent. was paid.

The *Telephone Works Company (late Berliner)*, Hanover, proposes to devote the net profits earned in 1925-26 to writing down certain items to strengthen the position of the company in connection with the conclusion of a community of interests with the Fuld Company, of Frankfort-on-Main.

Belgian Companies.

The *Compagnie Central de l'Industrie Electrique*, which is an investment concern, reports net profits of 352,000 fr. for 1925-26, most of which has been applied to depreciation.

The *Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels)* proposes to reduce its share capital from 36,750,000 fr. to 18,575,000 fr. by writing down the value of the shares from 500 fr. to 250 fr. At the same time it is intended to increase the share capital again to the former total by the issue of new shares of the nominal value of 250 fr. each. The reduction in the capital is for the purpose of writing down various assets.

Edison Swan Electric Co., Ltd.—The total profit for the year ended June 30th last was £143,911, as compared with £163,183 in the preceding year. The net profit, after meeting all charges, is £71,405, as against £88,344. The directors propose to maintain the dividend at 10 per cent., but the allocation to reserve is reduced from £50,000 to £40,000. A balance of £29,038 is carried forward; the amount brought in was £29,276. The report records the death of Mr. George Berry and the retirement from the board of Messrs. C. F. Spencer, A. F. Berry, J. Cross, H. J. C. Johnson, and J. W. Drake. Messrs. W. Shearer, A. H. Beatty, W. McGill, and I. C. A. Murray have been appointed directors. The meeting was to be held on Wednesday last.

Tata Hydro-Electric Power Supply Co.—The net profit for the year ended June 30th last was Rs.19,82,934. To this is added Rs.3,77,719 brought forward, making Rs.23,60,653. Interim dividends at the rate of 7 per cent. per annum on the preference and at 6 per cent. per annum on the ordinary shares have been paid. It is now proposed to put Rs.3,00,000 to reserve and to pay final dividends at the rate of 7 per cent. on the preference and at 8 per cent., free of tax, on the ordinary shares, leaving Rs.1,75,763 to be carried forward.

Andhra Valley Power Supply Co.—The net profit for the year ended June 30th last was Rs.9,73,882. After paying two years' dividends on the preference shares, Rs.85,000 is set against depreciation of investment, Rs.1,00,000 is written off the deficit in the balance-sheet (reducing this to Rs.3,33,995) and Rs.1,03,589 is carried forward.

Buenos Aires Town and Dock Tramways, Ltd.—The receipts for the year ended June 30th last were £148,755 gross and £23,384 net. To the latter sum are added various amounts, including £1,738 brought forward, making £29,668. After meeting debenture interest, &c., and transferring £12,000 to the renewals reserve, it is proposed to pay a dividend of 1½ per cent. on the share capital (against 1 per cent.), and to carry forward £2,692. The company has secured a new concession which, it is hoped, will improve its position.

Marconi's Wireless Telegraph Co., Ltd.—The directors state that they have been informed by Sir Gilbert Garnsey, K.B.E., and Messrs. Cooper Bros. & Co. (the company's auditors) that the report of the results of their investigation into the position of the company and of its associates and subsidiaries will be completed early in January. When the report is received, the directors will proceed to consider the proposals to be placed before the ordinary general meeting, which will be held at the earliest possible moment.

Delaboie Electric Light and Supply Co., Ltd.—Presiding at the recent annual meeting, Mr. S. Radcliffe (chairman) said that the revenue had increased, but the response to his appeal last year for more capital had not been as good as desired. They had received £50 in capital before the issue of the balance sheet and £20 since.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

Perak River Hydro-Electric Power Co., Ltd.—£1,250,000 5 per cent. guaranteed debenture stock, scrip, fully and partly paid.

Shawinigan Water and Power Co.—$2,500,000 capital stock.

Southern Canada Power Co.—The report for the year ended September 30th records earnings of $1,289,121 gross and $913,561 net. The net surplus was $573,563. After paying the preferred and common dividends and transferring $138,900 (as against $121,365) to reserve, a balance of $166,365 is carried forward (as against $117,773 brought in).

Mann, Egerton & Co., Ltd.—The profit for the past year was £20,675, as compared with £20,207 in 1924-25. After paying 6 per cent. on the preference shares and 5 per cent. on the funding certificates, and allocating £3,000 to the redemption of these certificates, a balance of £6,747 is carried forward.

Montreal Light, Heat and Power Co.—A dividend of 33⅓ cents per share has been declared for the two months ended December 31st. The date of payment of the quarterly dividends is to be brought forward a month hereafter.

Claud Hamilton, Ltd.—The directors again regret their inability to recommend a dividend on the ordinary shares. After meeting the preference dividend, a balance of £6,274 is carried forward.

Crompton & Co., Ltd.—The directors have declared a dividend at the rate of 7 per cent. per annum on the preference shares for the six months ended September 30th.

Chili Telephone Co., Ltd.—An interim dividend of 6 per cent. per annum, free of tax, has been declared on the ordinary shares for the half year.

International Light and Power Co., Ltd.—The directors have declared the dividend on the 6 per cent. preference shares for the half-year to December 31st.

Falkirk Iron Co., Ltd.—An interim dividend of 5 per cent. (actual) has been declared, as in 1925.

W. & T. Avery, Ltd.—An interim dividend of 5 per cent. has been declared on the ordinary shares.

Stocks and Shares.

TUESDAY EVENING.

In following the usual custom of making New Year's Eve comparisons, that shall carry interest rather than odium, the first thing to observe amongst electricity issues is, of course, the change that has occurred in the London electric supply group. This is the first time in four years when the list of prices has not exhibited rises almost dramatic for a quiet section of the industrial market. Capitalisation of reserves and distribution of bonus shares in connection therewith have occurred, and the range of prices now stands upon a dull uniformity of line bounded by 24s. as the minimum and 25s. as the top.

Amongst those so treated are the ordinary shares of the Charing Cross, Chelsea, Kensington, London, St. James', South London and Westminster Companies. These represent, ex rights as they are, a rise in some cases against the prices of a year ago. But Bromptons and Metropolitans, where a straight comparison is possible, are both a little lower. In our table we add the prices of December, 1924, to those of last year and to-day, as follows:—

ELECTRICITY SUPPLY SHARES.

Ordinary share.	Dec., 1924.	Dec., 1925.	Now.
Brompton	1⅝	1⅝	1⅛
Charing Cross	45/6	48/9	24/-
Chelsea	37/6	42/6	25/-
City of London	47/6	60/9	42/6
County	52/6	59/6	36/-
Kensington	10⅞	13½	24/-
London	33/6	33/6	24/-
Metropolitan	37/6	40/6	39/6
St. James'	12/-	15½	34/-
South London	2½	2⅝	24/6
Westminster	11	46/6	24/6

It must be admitted that a shade of disappointment is felt in regard to certain of the capitalised reserve distributions, but when all the circumstances are taken into account, we venture to think that shareholders have reason for a good deal of quiet satisfaction at the manner in which the business has "panned out." The full strength of the forces of Labour, and of the Parliamentary risks that have had to be surmounted, circumvented and placated, are known only to a very few of those men who have stood behind the scenes during the last 10, or even 20, years.

The Home Railway market has lain under the shadow of the general strike and the coal stoppage, but these affected the stocks of steam railways more than those of the Undergrounds. Districts are well up on the year. The long-deferred reorganisation of capital in the Underground Electric Railways of London has at length become achieved; the £10 shares have disappeared, and the company's ordinary capital is now in shares of £1 denomination. A few comparisons are:—

RAILWAY STOCKS AND SHARES.

Stock or share.	Dec., 1924.	Dec., 1925.	Now.	Rise or fall.
Central London Ord....	74	68	69	+1
Metropolitan	83	69	63	—6
District	56	47	53½	+6½
Underground "A"	9/6	7/-	12/-	+5/-
,, Inc.	100	98	103	+5

During a year in which wireless has received so great an impetus through the popularity of broadcasting, it is rather melancholy to notice the continued shrinkage in the price of Marconis. The ordinary have fallen 8s. 9d. within 12 months, and £1 as compared with December, 1924. The company's affairs have been under investigation for several months, and the report of the Committee is expected to be published on January 4th next. A heavy fall took place in Burndept Wireless preferred shares, but was checked upon Johnson & Phillips lending the company money.

The Eastern group of cable companies pursues its steady way of calm prosperity. A fall followed upon "Beam" developments in connection with wireless, but the decline became wiped out by investment support. South American telephone business has enjoyed a successful year. A very uncommon incident was the sale of the Venezuela Telephone Company, and its subsequent falling through when everything seemed settled. We give three years' figures for comparison:—

TELEGRAPHS, &C.

Stock or share.	Dec., 1924.	Dec., 1925.	Now.	Rise or fall.
Anglo-American Pref	104½	103	101	—2
Eastern Extension	17	18	17¾	— ¼
Eastern Telegraph	172½	177½	177½	—
Globe Ord.	17¾	18⅜	18⅝	+ ¼
Great Northern	29½	33	27	—6
Indo-European	32½	45½	47½	+2
Marconi	13/9	22/6	13/9	— 8/-
United River Plate	6⅛	7⅞	7¾	+ ⅛
Western Telegraph	17	18	17½	— ½

What are called cable and equipment shares have spent an active year in the Stock Exchange markets. Prices have run in favour of proprietors. Sharp movements in Callenders, Henleys, Siemens, Metropolitan-Vickers, British Insulated, and others have kept public interest on the *qui vive*. An offer for sale of Telephone Manufacturing shares at 7s. 6d., in the summer, left underwriters with 94 per cent. of the stock. The price dropped to 1s. 6d. discount; it is now 8s. 3d., or 9d. premium. Johnson & Phillips at 3 are 3s. 9d. higher on the year. Siemens at 30s. have gone back. Edisons at 11s. 3d. show a rise of 2s. 3d. on the offer of a group to buy shares in the undertaking; the price lost 1s. 6d. a few days ago, following publication of the report. British Insulated at 67s. 6d. compare with 55s. a year back. Half-a-dozen other representative examples are:—

MANUFACTURING.

Share.	Dec., 1924.	Dec., 1925.	Now.	Rise or fall.
Babcock	23	2⅞	22	+⅛
British Aluminium	29/9	38/-	48/-	+10/-
Callenders	2½	3¼	3⅛	+⅛
General Electric	21/6	29/-	31/-	+3/-
Henleys	58/9	70/-	44	-4
India Rubber	17/6	21/3	21/3	—

British Electric Traction at 144¼ is 25 to the good. Brazilian Tractions at 106 go against 84¼ in December, 1925, and 58 in December, 1924. British Columbia deferred ties with British Electric Traction, being 25 points higher, at 149¼. London United Tramway 4 per cent. debenture finishes the year as it started. Mexican Utilities have been jumpy and erratic. The Bank Rate did not vary from 5 per cent. during the 12 months. Money has been plentiful, over the period, for new issues, and, in spite of a possible rise in the income-tax next April, the investment markets and the speculative sections will start the New Year with a justifiable feeling of hopefulness.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	1925.	Price Dec. 28 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	1⅛	—	6 13 4
Charing Cross Ordinary	1	15	15	25/-xr	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2⅛	—⅛	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	26/-xr	—	... ...
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	30/6	—	6 11 2
Kensington Ordinary	1	15	15	24/-	—	5 16 8
Lancs. Light and Power	1	7½	7½	24/-	—	6 2 5
London Electric	1	10	10	24/-xr	—	5 17 8
do. do. 6% Pref.	5	6	6	6⅝	—	5 11 7
Metropolitan	1	11	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6-xr	—	6 3 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	1⅛	—	5 17 11
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	24/6	—	5 14 3
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	63	—	7 18 8
do. District	,,	3½	3½	56½	—	6 4 0
Underground Electric	£1	Nil	Nil	12/-	—	Nil
do. do. Income	Bonds	6	6	103	—1	*5 17 6

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	3	10	2⅛	—	3 14 4
Chili Telephone	5	5	6	6¼	—¼	4 7 4
Cuba Sub. Ord.	10	5	5	7	+¼	7 5 6
Eastern Extension	10	10	10	17⅛	—⅛	*5 11 4
Eastern Tel. Ord.	Stock	10	10	177½	—1	*5 12 1
Globe Tel. and T. Ord.	10	10	10	18½xd	—	*5 8 1
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	9½	10	47½	+½	*5 5 10
Marconi	1	10	Nil	¼	—	... ...
Marconi-Marine	1	10	7½	1⅜	—	6 13 4
Oriental Telephone Ord.	1	13	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 2 3
Western Telegraph	10	10	10	17½	—	*5 16 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3	+½	9 11 4
do. do. 2nd Pref.	5	6	6	2½	—	10 13 4
do. do. 5% Deb.	Stock	5	5	66½	+1	7 19 8
British Electric Traction Ord.	,,	7	8	144½	—	5 10 9
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	106	—2½	4 12 2
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	88½	+1	5 14 3
do. do. Preferred	,,	96/-	136/9	118½	—	*5 6 0
do. do. Deferred	,,	129/5	8	149½	+3	*5 9 3
do. do. Deb.	,,	4½	4½	79½	+1	5 8 3
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/6	—	Nil
London United Tram. Deb.	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	63½	+1	8 0 0
Mexican Light Common	100	Nil	Nil	81½	—	Nil
do. Pref.	100	Nil	Nil	76½	—	Nil
do. 1st Bonds	—	5	5	54½	—	7 15 0
Yorkshire (West Riding)	1	5	—	12/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	52/6	—	4 19 1
British Aluminium Ord.	1	5	10	48/-	—	4 3 4
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	67/6	—	4 9 0
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3½	—	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	£/-	10	10	11/3	—1/6	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	31/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1½	—	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 2
Gen. Elec. Pref.	1	6½	6½	22/6	—	5 15 7
do. Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	16	20	43xd	—	4 11 6
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	3	—	5 16 8
Met.-Vickers Ord.	1	8	8	22/6	—⅛	6 14 9
do. Pref.	2	8	8	2⅛	—	6 18 4
Siemens Ord.	1	7½	7½	1⅛	—	5 0 0
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Dec. 28th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	6½d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£35	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£13 10s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£107 to £112	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£266	
Grade II	,, ,,	£186	
Grade III	,, ,,	£99	
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	
c ,, Tubes (solid drawn)	,,	1/0 to 1/0½d.	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£93	...
c ,, Sheet	,,	£93	...
c ,, Rod	,,	£93	...
d ,, (Electrolytic) Bars	,,	£64 15s.	10s. dec.
d ,, ,, Sheets	,,	£144 10s.	...
d ,, ,, Wire Rods	,,	£74 15s.	10s. dec.
d ,, ,, H.C. Wire	per lb.	9½d.	...
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
a German Silver Wire	,,	2/2	...
b Gutta-percha, fine	,,	8/-	...
b India-rubber, Para fine	,,	1/5 to 1/5½	½d to 1d inc.
l Iron Pig (Cleveland No. 3)	per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£30 10s.	5/- dec.
g Mercury	per bot.	£17 10s.	...
e Mica (in original cases) small	per lb.	3d. to 8/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/3½	...
p ,, ,, wire	,,	1/4	...
o Platinum	per oz.	£33	...
d Silicium Bronze Wire	per lb.	10½d.	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£296 to £298 10s.	£10 5s. dec.
a ,, Wire, Nos. 1 to 16	per lb.	4/9	4d. inc.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Large Transformers with Auxiliary Control.—The Philadelphia Electric Co. has recently installed in its Schuylkill station what are claimed to be the largest self-cooled single-phase transformers built to date. Their total capacity is 120,000 kVA, and they are arranged in two banks. They were shipped completely assembled in their permanent tanks, immersed in oil. They are of the General Electric Co.'s (America) manufacture, of the standard core type and circular-coil construction, and are designed for operation at 60 cycles, 72,450 V star, to 13,800 V delta. They are supplemented by separate voltage-regulating transformers so connected to the main circuit at the neutral end of the h.p. side as to afford a boosting and bucking effect over a total range of 10 per cent. The equipment controls a tie line between the Schuylkill and Chester stations of the Philadelphia Electric Company; a similar arrangement is installed at the Chester end of the line. The method of voltage control embodies a new development of the G.E.C. by which it is possible to vary the transformer ratio, either of the main power transformers or the auxiliary regulating transformers, without bringing the tap voltage leads out of the main transformers, and with only two circuit-breaking devices for each three-phase circuit. This involves the use of two separate but identical circuits for the winding which is to afford the voltage variation, and these are normally in parallel, but during times of voltage variation, one circuit carries the total load while the other is off-circuit and undergoing tap changes. The actual changing of the taps is accomplished by special ratio adjusters designed for low torque and high contact pressure. The proper sequence of operations is insured by a single master mechanism for each bank, which is motor-operated and remotely controlled at the switchboard. Full automatic protection is provided for the plant, which is designed for outdoor use.

The Automatic Control of Large Pumps.

Some of the Switchgear at the Southampton Docks.

THE Southern Railway Co.'s ocean port of Southampton is a good example of the rapid increase in the use of electrically-operated machinery in docks. Development in this direction during the past 15 years was outlined in our issue of September 18th, 1925, page 471, and it is of interest to note that the controlling equipment for the electrically-driven pumping plant of the various graving docks is of the push-button-operated automatic type, with the exception of the controllers of the high-pressure turbine pumps used for hydraulic power purposes, which are automatically operated by means of accumulator tappet switches, and the small sets controlling the drainage, priming, and house pumps, which are hand operated.

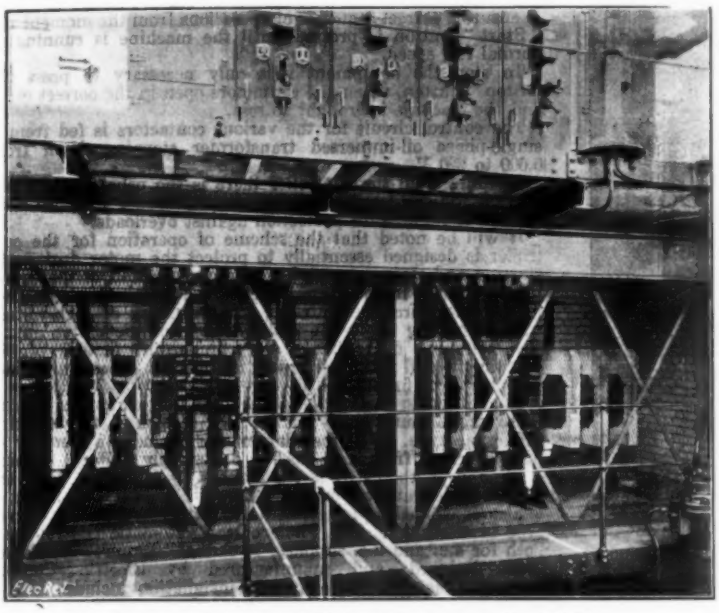

Fig. 1.—Four Triple-pole High-voltage Contactors, No. 5 Dock.

The chief interest in the automatic equipment centres round the controllers for the large de-watering and impounding pumps, which are driven by asynchronous-synchronous motors operating directly off the 6,600-V supply mains. The motors of this type are of 1,200 h.p., 950 h.p., and 350 h.p., and the system of control is identical for each size. The 1,200-h.p. motor is claimed to be the largest of this type at work in this country, and, to the best of our knowledge, the largest asynchronous-synchronous motor in the world operating directly off a 6,600-V supply system and controlled automatically. Since all the controllers for the asynchronous-synchronous motors are identical, with the exception of the number of steps and the size of the contactors, it will suffice to describe the operation of the 1,200-h.p. equipment only.

The automatic controller comprises two triple-pole high-voltage air-break contactors, with charging resistance for the stator circuit, a panel carrying the various contactors and relays for the rotor and exciter circuits, and an operating pillar with the regulator and instruments for the exciter; the pillar also carries the "Start-Stop" push-buttons and has been installed in the most convenient position from the operator's point of view.

The group of four triple-pole h.p. contactors illustrated in fig. 1 are operating in connection with two of the large asynchronous-synchronous motors installed in No. 5 dock; each h.p. contactor is mounted separately on an angle-iron frame, and the complete assembly is enclosed by expanded metal screenwork, the access doors being interlocked with the main oil switches, which must be opened before entry can be made to the h.p. contactor enclosures. This arrangement ensures complete safety in the event of adjustments being necessary to this part of the equipment. Each contactor is operated by means of two standard low-voltage a.c. magnets, one of which is mounted at each end of the shaft which carries the three moving contacts; the shaft is of steel covered with mica and is provided with a stage of porcelain insulation at each end, so that it is completely insulated from the framework, and each phase also is efficiently insulated. The stationary contacts are mounted on specially-insulated heavy mica-covered steel bars. Both the moving and the stationary contacts have a rolling action, and are also fitted with large arcing horns; a double magnetic blow-out is provided on each phase, and arc shields with renewable linings are fitted as well.

The charging resistances, one bank of which is used in conjunction with each pair of triple-pole h.p. contactors, can be seen mounted above the contactors in fig. 1; they are of the metallic type, being wound on mica-insulated steel tubes and mounted on porcelain insulators. Connections throughout are of the mechanical type, no solder being used in the construction of the resistances.

The contactor panel and resistance for the 1,200-h.p. asynchronous-synchronous motor is illustrated in fig. 2. On the panel are the low-voltage contactors and relays, which are mounted on specially treated slate slabs and enclosed in a sheet-steel case, with hinged inspection doors. All the contactors are operated by standard low-voltage a.c. magnets and, where necessary, they are provided with magnetic blow-outs. The a.c. magnets are of the laminated single-phase type, fitted with special silencing windings embodied in the laminations of the stationary portion, in order to secure quiet operation; the operating coils are wound for the full supply voltage. The levers carrying the moving contacts are mounted on substantial square shafts, carried in plain bearings. The contactors are directly operated by the magnets, no links, or toggle mechanism, being employed. The contacts have a rolling action and the copper tips are easily renewable. The main resistances are mounted alongside the rotor panels and suitably enclosed. They are of the metallic "unbreakable" rustless pattern.

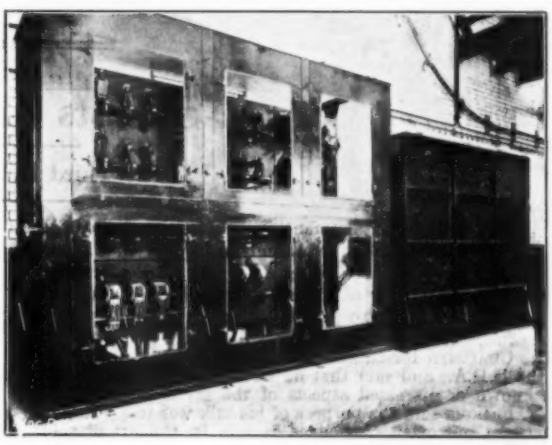

Fig. 2.—Contactor Panel and Resistance for 1,200-h.p. Asynchronous-Synchronous Motor.

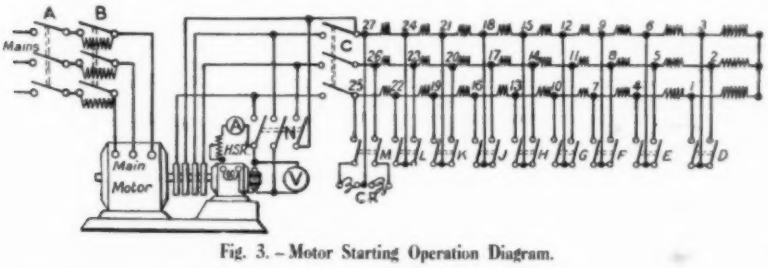

Fig. 3.—Motor Starting Operation Diagram.

The automatic timing element which controls the closing of the various contactors is very simple in design and is provided with means of adjustment for varying the period between the closing of each individual contact as well as for increasing, or reducing, the total time of operation of all the contactors. It comprises a number of disks connected to a moving spindle, there being one disk for each contactor; each disk makes contact with a pair of steel studs, which are provided with renewable copper contact pieces. In addition to the timing element,

current accelerating relays are used at certain points in the cycle of operations, so as to ensure the correct functioning of the controller.

Two of the operating pillars are to be seen in fig. 4; they carry the "Start-Stop" push-buttons for each equipment as well as the shunt regulator and instruments for the exciter. In addition, a pair of push-buttons has also been installed close to the machine, so that the equipment can be started either from the operating point where the pillars are installed, or from the floor of the pump house.

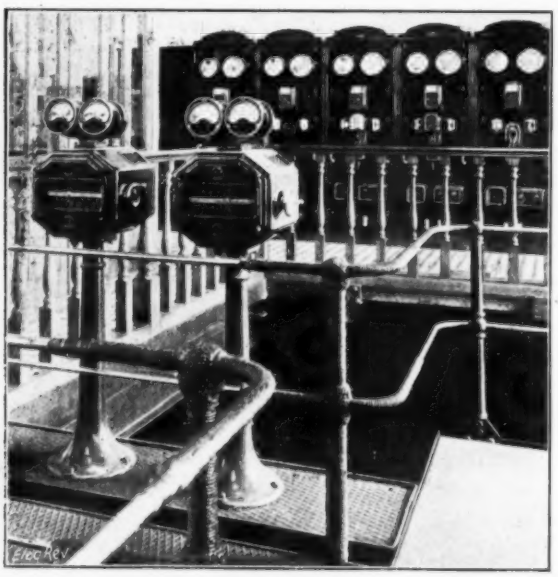

Fig. 4.—Two Motor Operating Pillars.

The starting operation of one of these asynchronous-synchronous motors can be followed by reference to the schematic diagram, fig. 3. When the requisite "Start" push-button is pressed, the high-voltage contactor A closes the stator circuit through the charging resistance, which is designed to limit the switch-on voltage to approximately 50 per cent. of the line voltage; after a pre-determined time interval, the second high-voltage contactor B closes, short-circuiting the charging resistance, and thus applying full voltage and full magnetising current to the stator of the motor. The buffer resistance D closes next, thus allowing sufficient current to pass to start motion, after which the accelerating contactors E to M close successively under the control of the master controllers; the final contactor M is provided with a current relay, which, at the correct moment, disconnects the rotor entirely from the motor by opening contactor C; the synchronising contactor N then closes automatically under the control of a relay which connects the exciter to the slip rings at the right moment, thus causing the motor to pull into step and run as a synchronous machine. The controller is provided with the necessary relays to ensure a correct sequence of operations from the moment the "Start" button is pressed until the machine is running at normal full speed.

To stop the equipment it is only necessary to press the "Stop" button, when the contactors open in the correct order and the machine is brought to rest.

The control circuit for the various contactors is fed from a single-phase oil-immersed transformer stepping down from 6,600 to 220 V.

Separate from the controller there is the usual main triple-pole oil-immersed hand-operated circuit breaker provided with automatic releases for protection against overloads.

It will be noted that the scheme of operation for the controller is designed essentially to protect the motor during the starting and stopping periods. The combination of the charging resistance in the stator circuit and the buffer resistance in the rotor circuit, eliminates the possibility of high-voltage surges building up in the end windings of the motor during the switching operations, a very important feature of the equipment, and it has performed its function successfully since the plant was first installed.

In addition to these large asynchronous-synchronous motors, there are a number of smaller a.c. motors of the slip-ring induction type. The installation also includes a number of pumps driven from a 480/500-V d.c. supply system, forming a stand-by in the event of the a.c. supply failing. One of the 1,200-h.p. de-watering pumps is driven by a d.c. motor, which is also controlled by means of push-buttons with an automatic type of controller. The whole of the automatic control gear, both for a.c. and d.c. supplies, is of the "Empire" contactor type designed and manufactured by Electric Control, Ltd., of Glasgow. The complete installation includes 16 a.c. controllers totalling 4,258 h.p., and 8 d.c. controllers totalling 1,348 h.p., or 24 controllers in all, amounting to 5,606 h.p.

The installation provides an interesting example of the ease and simplicity with which large electrically-driven power units can be started and stopped by the simple operation of pressing buttons, and the importance of the installation is a striking testimony to the reliability of modern automatic control gear.

Some Secrets of the Selling Art.

The Third E.D.A. Conference.

At the third E.D.A. salesmanship conference of the season, on December 17th, a lecture was given by Mr. G. S. Francis on "Some Secrets of the Selling Art." Mr. J. W. Beauchamp (director and secretary of the E.D.A.) presided, in the absence of Mr. P. J. Pybus (managing director of the English Electric Co., Ltd.), who was to have taken the chair.

The Chairman introduced Mr. Francis as the chief lecturer of the E.D.A., and said that he would deal with some of the less known or discussed aspects of the art of selling.

Mr. Francis said the purpose of his talk was to disclose some important but often overlooked factors in the art of selling, with the object of stimulating the imagination of salesmen, and engendering pride in their profession and thus add a zest to their work. It might be interesting to note, in passing, the peculiar function which the salesman performed in the circle of economic activity. The personal qualities and abilities of the producer entered directly into the product, just as the personal qualities and abilities of the consumer entered into its use, but neither in the product nor its use could any trace of the salesman's work be discovered. The salesman worked, in fact, as what was known in chemistry as a catalyst, one of those mysterious substances which did not enter into the substance of chemical compounds, yet whose presence was essential if effective union was to be made. Until recent times, the art of selling was to a high degree personal, and the links between producer and consumer were all human links. With the advance in mechanical and mass production, however, with the rise of big industry and big business, goods had to be distributed more quickly and in larger quantities than could be achieved by the unaided services of individual salesmen. Therefore, "mass production" had to be assisted by "mass suggestion" through the medium of Press advertisements, circular letters, and the organised propaganda and publicity of bodies like the E.D.A. The underlying aim of that process of mass suggestion was to create a mental atmosphere within which the efforts of individual salesmen could work with more ease, less friction, and greater certitude. If people could be induced to think electrically, induced to turn naturally and instinctively to electrical solutions of their problems, the individual salesman was relieved of a lot of mere spade work, and the task of selling electrical apparatus was made easier. Thus the salesman, the supply undertakings, and the makers of plant and apparatus all participated in the benefit. Personality was still necessary in the individual salesman, but he should never under-estimate the value of the associated efforts of trade organisations. There were certain tricks of the trade by which reluctant customers might be persuaded to buy goods which they did not want. Such methods, however, usually had an unpleasant reaction, and could never build a lasting connection. Truth in selling was essential. The object of salesmanship was to create in the mind of the customer a desire to possess the particular thing one was selling, above all others. Therefore, the art of selling involved some action by the salesman on the mind or emotion of his customer, and any attempt to acquire an effective knowledge of the technique of the selling art implied some knowledge of human nature, some study of the relation of the conscious and subconscious mind, together with the nature of the effects produced by the various forms of external stimuli.

Not long ago, in giving a lecture before the E.D.A. on "Suggestion and Auto-suggestion in Salesmanship," Mr. H. B. Atkinson, speaking of the difficulty of studying human motive and character had said: "I believe this can be overcome . . . by treating human agency or, as I prefer to call it, human dynamics, as a scientific subject; by classifying it as a science, I mean that there are relations of cause and effect which, in the final analysis, are definite and reproducible if only we could take the trouble to find out the connecting laws." That point of view, however, was directly opposite to that which he (Mr. Francis) himself held because he felt that the study of human nature was an art rather than a science. In human nature there were too many variables for exact scientific procedure. The ability to perceive those factors and their connections correctly and the ability to relate them harmoniously so as to produce the desired action

or result was purely a personal ability and, therefore, partook of the character of an art. Mr. Francis referred to some recent researches by Dr. Rudolph Steiner into the psychic and spiritual nature of man, and stated that it was impossible to come to any effective knowledge of man without some grasp of his threefold nature. There was first the physical body of man, but behind this or within it lived a second form which was not physical but psychic, but it was most intimately connected with the physical body which it used as an instrument. To complete the picture we had to imagine behind or within these two a third which gave purpose and direction to the whole. It was impossible in the time available to work out any practical applications of this knowledge in such a lecture as the present one, and in any case the practical application of an art was a purely personal thing which every individual must work out and perform for himself. The instrument which the salesman used in his endeavour to influence the minds and actions of others was speech and the separate tools were words. In our time, language had become a very abstract thing and, except in the hands of the few poets who had managed to survive this very utilitarian age, words were just used to convey thoughts or ideas. Words possessed, in addition, colour or tone and form, and those qualities played more directly upon the emotions and the will, which were the centres of human action. That subject again opened up extensive vistas. The salesmen of the electrical world should master the secrets of their profession, to acquire a knowledge of human nature, and of the written and spoken word so that they might induce humanity to turn from their old ways and embrace the new.

Discussion.

In opening the discussion, the CHAIRMAN said that the lecture had shown that the greatest study of mankind was man, and it had also put forward a few other elementary truths which it was a great mistake to forget or lose touch with. At present the electrical industry was making such a great demand upon the public that there were not enough born salesmen, and it was therefore necessary to make salesmen and saleswomen. The Council of the E.D.A. had determined to do that in the future in a far more practical and effective way than had hitherto been possible.

Mr. L. GASTER referred to the necessity for truth in salesmanship, and urged that salesmen should not adopt the policy of decrying their competitors' goods. A superficial knowledge of the technique of the goods being offered for sale was not sufficient nowadays; there was a school in France where salesmen were trained in a thorough manner by being taken through classes dealing with electrical apparatus so that they were given a close knowledge of all its features.

Mr. W. E. BUSH (E.I.-M.A.) said it was difficult for him to relate much of what the lecturer had said with the sale of electrical goods and apparatus. Could they imagine a salesman going to a contractor who had just got an order for wiring a housing estate at a cut price and talking to him of the circulatory or rhythmic system of the human body, and then expect to get an order for lamps or ceiling roses? As regarded more commonplace matters, the problems of salesmanship in the electrical industry were rather different from those of many other industries. For instance, the salesman dealing in soft goods, ladies' costumes, and so on, had already had his market created for him by very skilful advertising or the natural desire of people to buy these goods, whereas the electrical salesman had to educate his public before he could effect sales. The present position seemed to him to be that there were too many salesmen on the road and not enough educators. He had been told that there were 40 manufacturers of electric heaters, and yet the market was limited. It was necessary to have some collective scheme of education of the public in order to increase the market, and if all the salesmen who were engaged in order-getting at the moment would spend a limited amount of their time in educating the public a much bigger market would be created.

Mr. F. T. HALL (North Metropolitan Electric Power Supply Co.) regarded the paper as one representing the high-water mark of individuality in salesmanship, and he deprecated the remarks of Mr. Bush on what he had called its "highbrow" character. What was wanted in salesmanship was individuality, not standardised salesmanship; our salesmen needed more knowledge. He suggested that some lectures on electrical matters should be given to salesmen.

Several other speakers discussed the paper in a general way, some agreeing that it did not appear, at any rate on the surface, to have much practical application to the everyday work of salesmanship, whilst others saw in it a means for widening the scope and ideas of salesmanship. The question whether the only right type of salesman was the so-called "born" salesman was also discussed, and varying views were expressed upon it.

Mr. FRANCIS, in the course of his reply to the discussion, said he was quite satisfied if he had started salesmen thinking on the lines indicated in the paper. As to whether a salesman must be born or could be made one by teaching, he said that all personalities differed, and some people could not be made salesmen if they had all the instruction in the world. The born salesman did the right thing sub-consciously, whereas the "made" salesman did the same things consciously, and experience had shown that people who did things consciously invariably reached a higher level than those who did them subconsciously.

Electrical Exports of Java.

THE following statement, based on the recently-issued official statistics, shows the values of the imports of electrical and allied material into Java and Madura during 1925. Comparative figures for 1924 have also been given for purposes of comparison and notes of increases or decreases added.

	1924. Guilder.	1925. Guilder.	Inc. or dec. Guilder.
Electric lamps, incandescent—			
Total	704,000	883,000	+179,000
From Holland	462,000	511,000	+ 49,000
,, Germany	163,000	224,000	+ 61,000
,, Japan	28,000	39,000	+ 11,000
Electrical apparatus—			
Total	736,000	883,000	+147,000
From Holland	264,000	242,000	- 22,000
,, Great Britain	30,000	65,000	+ 35,000
,, Germany	344,000	373,000	+ 29,000
,, Japan	38,000	76,000	+ 38,000
,, United States	37,000	73,000	+ 36,000
Electric wire and cable, copper—			
Total	1,000,000	1,017,000	+ 17,000
From Holland	609,000	586,000	- 23,000
,, Great Britain	7,000	13,000	+ 6,000
,, Germany	203,000	216,000	+ 13,000
,, Japan	153,000	178,000	+ 25,000
Dynamo-electric machinery—			
Total	899,000	602,000	-297,000
From Holland	560,000	159,000	-401,000
,, Great Britain	13,000	120,000	+107,000
,, Germany	245,000	262,000	+ 17,000
,, France	2,000	8,000	+ 6,000
,, Italy	48,000	21,000	- 27,000
,, United States	28,000	13,000	- 15,000
Other electrical machinery—			
Total	635,000	686,000	+ 51,000
From Holland	194,000	252,000	+ 58,000
,, Great Britain	52,000	25,000	- 27,000
,, Germany	308,000	310,000	+ 2,000
,, United States	51,000	7,000	- 44,000
Iron and steel wire for electrical transmission—			
Total	325,000	190,000	-135,000
From Holland	138,000	125,000	- 13,000
,, Great Britain	8,000	—	- 8,000
,, Germany	156,000	61,000	- 95,000
,, United States	10,000	—	- 10,000

Guilder = 1s. 8d.

France's Foreign Electrical Trade.

IN a recent monthly return prepared by the French Customs authorities, appear figures relating to the imports and exports for the whole of 1925. We reproduce below such of these statistics as apply to electrical goods and with them give the previous year's totals and the difference between the two sets of figures. In the case of exports the valuations given are those of the French Customs Commission.

Imports.

	1924. Thous. francs.	1925. Thous. francs.	Inc. or dec. Thous. francs.
Dynamo-electric machines—			
Weighing 1,000 kg. and over ...	20,100	21,000	+ 900
From 50 to 1,000 kg.	10,400	9,500	- 900
Less than 50 kg.	17,800	18,000	+ 200
Electrical and electrotechnical apparatus—			
Wound with insulated wire ...	39,400	34,000	- 5,400
Not wound with insulated wire	15,300	22,000	+ 6,700
Insulated wire and cable ...	3,600	7,800	+ 4,200
Commutators and parts ...	16,800	19,000	+ 2,200
Arc lamps and parts	31	130	+ 99
Accumulators and parts	3,700	6,000	+ 2,300
Dry cells	121	126	+ 5
Dynamo and motor frames ...	318	182	- 136
Incandescent lamps—			
Carbon filaments	410	366	- 44
Metal filaments	44,000	48,000	+ 4,000
Without caps	940	2,100	+ 1,160

Exports.

Dynamo-electric machines ...	60,000	73,000	+13,000
Electrical and electrotechnical apparatus	202,000	186,000	-16,000
Insulated wire and cable	52,500	22,500	-30,000
Commutators and parts	24,500	30,000	+ 5,500
Incandescent lamps	30,000	34,500	+ 4,500
Arc lamps and parts	390	210	- 180
Accumulators and parts	6,500	10,000	+ 3,500
Dry cells	2,600	2,600	—
Dynamo and motor frames ...	167	39	- 128

Hydro-Electric Development in New Zealand.

Further Important Contracts for British Plant.

IN view of the recent discussions on trading within the Empire it is of interest to note that further important contracts have recently been placed by the New Zealand Government for hydro-electric generating plant and transmission apparatus with manufacturers in Great Britain. The additional plant includes two large 20,000-kVA generating sets, two banks of step-up transformers, 11,000 to 110,000 V, and four large synchronous condensers, including one machine of 10,000 kVA capacity. The water turbines are being supplied by Sir W. G. Armstrong, Whitworth & Co., Ltd., while the contract for the alternators and the whole of the other electrical plant mentioned has been placed with the Metropolitan-Vickers Electrical Co., Ltd., which, it will be recalled, has already supplied a large quantity of equipment in connection with electrical development in New Zealand.

Fig. 1.—North Island Scheme.

The whole of the equipment is required in connection with the development of the North Island scheme (ELECTRICAL REVIEW, August 29th, 1924, p. 314), which is outlined in fig. 1. It will be recalled that the project provided for three main water-power stations, Mangahao, Arapuni and Waikaremoana, and their interlinking by 110,000-V transmission lines to which existing steam and small water-power stations are also connected.

The Mangahao station, fig. 2, (ELECTRICAL REVIEW, April 30th, 1926, p. 692) is already in full operation, and has a total capacity of 24,000 kVA. The second main generating station is under construction at the Arapuni Rapids, where power, estimated at an ultimate capacity of 160,000 h.p., is being obtained by diverting the Waikato River from the Arapuni Gorge into its old river bed. The first equipment for this station is expected to be completed by the end of 1927. The greater part of the output of the undertaking will be taken by the City of Auckland, but a considerable amount of energy will be required also for some nearer towns and for farming and dairy work in the Waikato country.

The equipment now ordered is for the first of a group of stations near Lake Waikaremoana, which will be the third main generating plant on the system. The ultimate capacity of the group will be about 150,000 kVA. The two generating sets will be designed for horizontal operation, running at 428.6 r.p.m. under a net head of 631 to 645 ft. of water from Kaitawa Lake, which is fed by the Waikaretahete River. The turbines will be Francis reaction-type machines, overhung on the alternator shafts, thrust bearings being incorporated with the alternator bearings. The alternators will be 14-pole machines 16 ft. 6 in. in diameter, and each weighing 130 tons. They will generate at 11,000 volts and have an overload capacity of 25 per cent. The transformers are to be used for raising the pressure to that of the main transmission system, each bank consisting of three shell-type units, water-cooled and arranged for outdoor service. The equipment includes oil-conservators and air-breathers, and thermometers for indicating the oil temperature and alarm devices for drawing attention to any failure of the cooling-water supply will be provided.

The scheme of interconnection involves special arrangements for voltage regulation and power-factor correction, and it is for this work that the synchronous condensers already mentioned are to be installed. The 10,000-kVA machine is for the Khandallah sub-station, fig. 3. It is designed for operation at 750 r.p.m., and will be accompanied by semi-automatic starting switchgear. Two machines, each of 1,500-kVA capacity, 1,000 r.p.m., equipped with fully automatic starting gear, will be required for the Dannevirke and Bunnythorpe sub-stations, and the fourth and similar machine will be installed at the Waikino sub-station in the Arapuni section.

Fig. 2.—Mangahao Station, Interior.

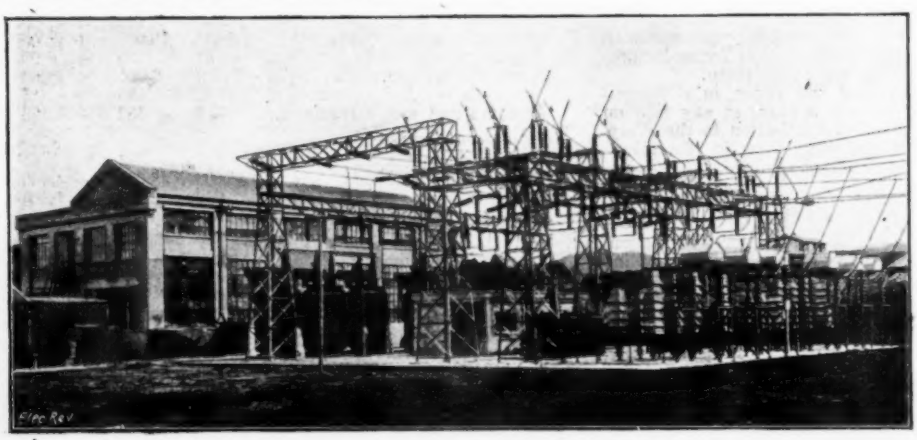

Fig. 3.—Khandallah Sub-station.

Of the projected 110,000-volt transmission line, 185 miles in length, over 100 miles is already constructed (fig. 1). It is expected that the remaining sections of the line and the construction of the first Waikaremoana power station will be completed, and the scheme of power transmission to supplement the Mangahao supply put into operation, by June, 1929.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Electrically Heated Plumbing Apparatus.

Of particular interest to colliery engineers is an automatic electrically heated plumbing apparatus, the Callender-Wilson automatic plumber, which has been developed by the CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton

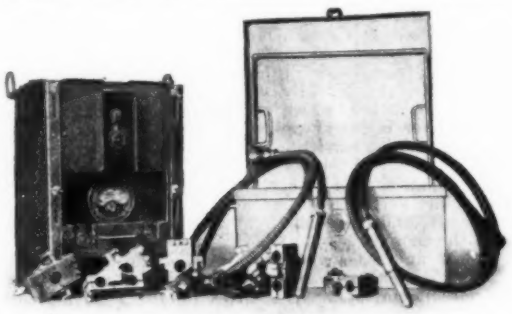

Fig. 1.—Callender-Wilson Plumbing Apparatus.

House, Victoria Embankment, London, E.C.4, for use in fiery mines and similar positions. It is made for two distinct operations, the plumbing of cable sheathing to the joint box

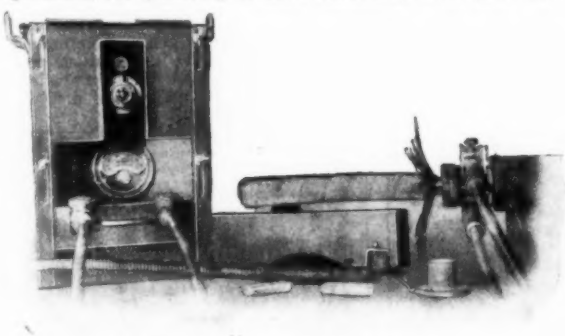

Fig. 2.—Plumbing Clamp in Position.

and the sweating of ferrules, briefly described below. The plumbing apparatus consists of a copper clamp or die, which is heated by a robust electrical heater, the clamp being used in conjunction with a cast-lead cone, or ready-made plumb, heavily tinned on the inside and so constructed that it is capable of being subjected to heavy compression and a certain amount of movement after it has been heated. The ferrule-sweating tool also consists of an electrically heated clamp, so designed that it is held in intimate contact with, and exerts pressure on, a patent ferrule which can be closed whilst the solder is still in a state of flux. It is claimed that a joint made by one of these ferrules will withstand a pulling stress 25 per cent. greater than that which can be obtained with an ordinary ferrule.

For obtaining metallic contact between the lead sheath and the joint box, and also the armour, cones into which heavily tinned copper bonds have been moulded are provided, and for jointing a brass gland to the lead sheath a double-ended cone is available. Further, the substitution of the plumbing cone for the existing mechanical bond can be arranged for by means of a split cone into which heavily tinned bonds are cast. The maximum current required for any operation is 80 A at 12 V, and the average heating period for either a plumb or a ferrule is 15 min., so that a battery is suitable for the supply. A 1-kW transformer is included in the apparatus for obtaining a supply from the mains. For the ferrule sweating the split ferrule is placed in position, after the application of a special flux, and closed sufficiently to enable the heat to be transmitted to the conductor, but not to prevent the access of the solder to the wires. The clamp is then applied and screwed up tightly enough to transmit the heat to the ferrule. Flux and solder are then served alternately, and the ferrule is squeezed up tightly by means of the special screw provided on the clamp. For plumbing the sheathing and the box, the ends of the box and the inner surfaces of the lead-cone flanges are first painted with a special compound, and the flux applied to the surface of the lead sheath; the cone is then pushed against the end of the box as tightly as possible. The two halves of the clamp are next placed on the cone and bolted together so that their faces meet. A slotted clamping plate is then slid behind the die and bolted up, so that the inner edge of the copper die is approximately ¼ in. from the outer face of the flange. Heat is then applied until the solder can be melted on the outer face of the lead cone which lies just within the copper die. The joint is allowed to stand for three minutes, when the clamp is further tightened up by means of the bolts on the box. The clamps are then removed, the armour placed in position, and the armour clamp bolted up.

The apparatus is compact and wholly contained in a suitable box, fig. 1. Fig. 2 shows the plumbing clamp in position.

A Standard Cable Sealing Box.

In order to meet the demand for a standard cable sealing chamber, certain of the leading English electrical manufacturers have produced such an apparatus, the "Standard Cable Sealing Chamber," fig. 3, embodying all the latest improvements for cable sealing and lead bonding. The new equipment has been placed on the market by the STANDARD SEALING-CHAMBER CO., LTD., 57-58, Chancery Lane, London, W.C.2, and will enable the manufacturer to standardise on one type of sealing chamber throughout the whole of his products, a particularly desirable arrangement in the case of mining equipment. The resultant advantages to the user are obvious; The chamber has been designed on the unit principle, so that any part or parts can be selected and used without reference to the remainder, making it suitable for use with varying types of cable and allowing a certain amount of latitude in the arrangement adopted for sealing the cable. The terminal box attached to the top of the device is intended primarily for use with electric motors, but it can, of course, be utilised on other types of apparatus. The box construction is such that the cables can be clamped in position without the use of solder, a split sleeve being fitted over the conductors. A special design of clamp terminal is employed for heavy-current apparatus. The actual chamber, fig. 4, consists of a cast-iron box made in two halves clamped together, the clamping surfaces being machined to prevent the egress of compound. Suitable glands are provided, and the box is fitted with a number of filling points to ensure that it is properly filled when mounted in any likely position. In order to provide an effectual break in the conductors, and to prevent any chance of the tails "shorting" inside the box, an additional terminal board is provided in the chamber. A suitable sheath gland can be temporarily fitted with one half of the box removed, so that the connections can be made with all the fittings completely accessible. An armour clamp is made to fit over the wiped joint. In cases where a wiped joint is not permitted, a split lead cone grip is provided. The apparatus is at present being manufactured in four standard sizes, for use with cables up to 0.4 sq. in., 3-core.

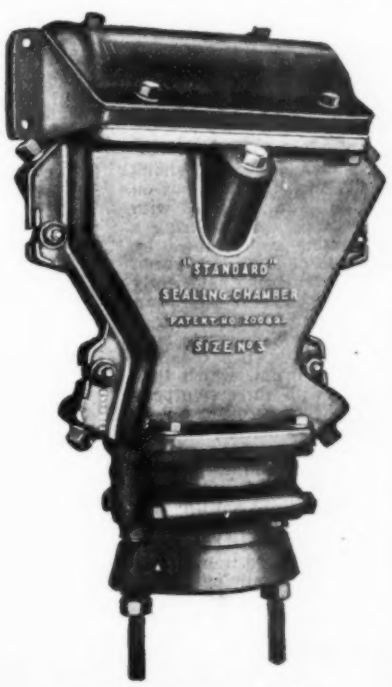

Fig. 3.—"Standard" Sealing Box.

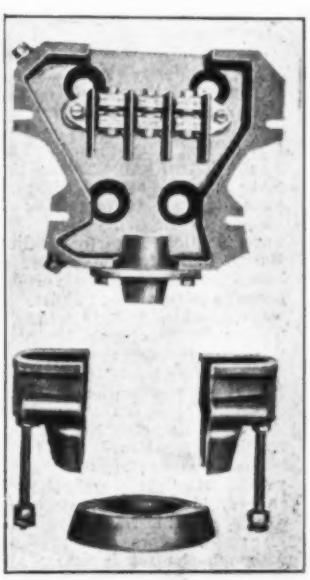

Fig. 4.—Sealing Chamber, Interior.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

The "Saveit" Fuse.

The recent article on the use of fuses in radio circuits (ELECTRICAL REVIEW, December 3rd, 1926) has prompted Messrs. A. H. Hunt, Ltd., to send us a sample "Saveit" fuse, and to point out the other side of the argument. The device incorporates a special fuse having a consumption of 0.05 A at 1.5 V, which will protect a single dull-emitter valve of the 0.06-A type; but it is explained that the fuse will protect a whole series of valves, "since the relative current consumption of the fuse, on the one hand, and the aggregate taken by the valves, on the other, are always in favour of the fuse breaking down before the valves, as the number of valves are increased. The fuse will pass the current satisfactorily up to about 20/25 milliamps., but if a greater current is required, then an ordinary flashlamp bulb fitted in the holder will be as good a protection to the whole series of valves as the standard fuse, since to take this current consumption a sufficiently large number of valves will be in use and be consuming more current than the small flashlamp bulb."

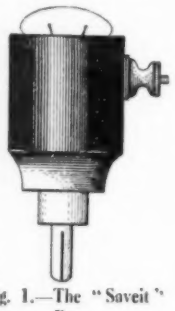

Fig. 1.—The "Saveit" Fuse.

The fuse can be supplied with a plug to fit in the socket of the standard h.t. battery of the dry-cell type, as shown in fig. 1, or with a spade terminal to fit under a wet accumulator terminal. A new model for baseboard mounting is being made for incorporation in the set.

The main point in this connection is that the experimenter, or, for that matter, the ordinary user, does not wish to be bothered with what may appear to be elaborate fuse arrangements; but if he can insert a simple fuse of this nature in place of his negative wander plug in the battery, and it is brought home to him that he may save himself several pounds' worth of valves, he will spend the extra money to effect such protection.

New "Gecophone" Products.

The popularity of the supersonic heterodyne receiver shows no sign of falling off. The eight-valve model, fig. 2, put on the market by the General Electric Co., Ltd., is fitted with special condensers which give uni-control, thus securing a long-desired convenience. The condensers are operated by means of two knurled disks projecting through an escutcheon plate in the centre of the panel, the disks being sufficiently close together to permit of them being rotated with two fingers at the same time. They are connected through a novel friction drive to a calibrated drum which serves as a station indicator, the setting of each station when obtained being recorded on the periphery of the drum, which thus provides a permanent chart. A switch with three stop positions provides a wide tuning range; the first covers 240 to 600 metres; the second position 560 to 1,400 metres, and the third 940 to 2,940 metres.

The choke method of l.f. amplification has been incorporated, and anode rectification is used on both the first and second detector valves, an arrangement which dispenses with grid leaks, the necessary grid bias to these valves being furnished by the l.p. battery. The l.f. stage of the set is connected to the receiving stage by means of a special tapped-transformer which, joined to a control switch with eight tappings, gives an easy means of volume control: the l.f. valves are individually grid biased, and all the valves are fitted with fixed filament resistors as a preventative to their being overrun. Although the set is fitted with auxiliary controls, namely, reaction and potentiometer, once they have been adjusted, they can be left alone, so making the set a uni-control one for all general requirements. The frame aerial is of the centre-tapped type, loaded for the longer wave-lengths, and reaction control on the frame is made use of for all ranges. The set is designed for Osram DE8 valves in the first five positions, and Osram DE5 type in the last three positions.

The "Gecophone" portable supersonic heterodyne set, fig. 3, introduced this season is a truly portable one. The complete equipment, comprising a 7-valve set, loud-speaker, batteries, and frame aerial, is housed in one cabinet of the following dimensions: 21 in. by 15 in. by 9½ in., mahogany finished, and on the panel, which is enclosed by folding doors when the receiver is out of operation, are the knobs and dials of two slow-motion condensers (for tuning the frame and oscillator circuits) set at the top side by side, and below are reaction- and volume-control knobs, with a range switch between. The frame aerial is contained in a hinged door at the back of the set; under normal circumstances the set can be worked with the door closed, but added volume is obtained by opening the door and making use of the directional property of the frame. The loud-speaker compartment is situated at one side, the circuit employing five valves on the receiving side and two for purposes of low-frequency amplification; the five receiving valves are of the Osram DE3 type, and the two in the l.f. stage of the Osram DE5 type. Instead of rheostats, fixed filament resistances are used, and the wide tuning range is split into two sections; this is contrived without the use of plug-in coils, the range switch also serving the purpose of a "battery off" switch.

The G.E.C. has recently introduced two cabinet and one cone loud-speakers; both the former types are of oblong shape, set on moulded feet, and have elliptical grills. The materials used for, and the conformation of, the sound chamber reduce self-resonance, and the mechanism itself is of the electro-magnetic type, with provision for adjusting the diaphragm clearance; the windings are adjustable, and by an interchange of the strapping of the terminals maximum results in both tone and power are obtained either when power valves of average impedance (such as the Osram DE5 and LS5) are used, or when power valves of low impedance (such as Osram DE5a and LS5a) are used. The cone type, on a shapely stand with a metal base, is fitted with a balanced-armature pattern of movement; the cone is adjustable for position, the canting device by which it can be tilted and fixed covering any angle between the horizontal and the vertical. The overall height of the speaker is 21½ in., and its diameter 16½ in.

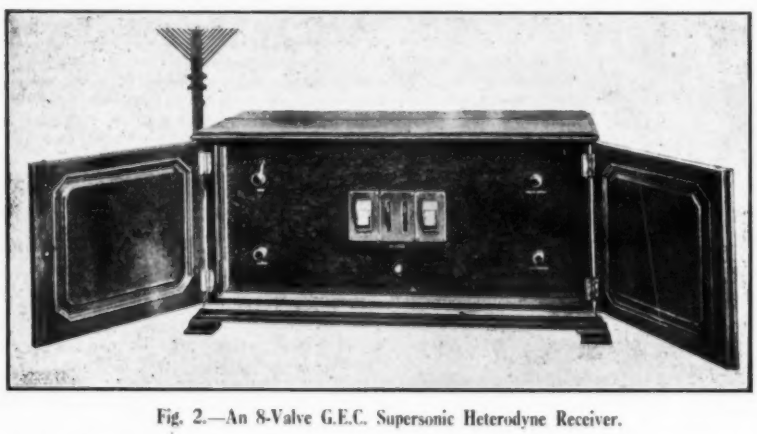

Fig. 2.—An 8-Valve G.E.C. Supersonic Heterodyne Receiver.

Fig. 3.—A Portable Super-Heterodyne Set.

Two new "Gecophone" batteries designed for wireless work are both of 66 volts; one has standard units and the other "super-capacity" units, while the improved covered container adds to their appearance and protection. Each consists of 48 cells, arranged, in the case of the standard type, in series of 12 in one unit and in the case of the super-capacity type, eight in one unit, so that the units can be simply interchanged, and ease of replacement is secured. Spring clip terminals are provided.

Mullard Valves.

For a manufacturer to submit his goods to the recognised Government laboratory to be tested under impartial and vigorous conditions, and to publish the report in its entirety is an exhibition of the highest confidence in the reliability and utility of his goods. In July, 1926, a number of "P.M." valves, taken from stock, were submitted to the National Physical Laboratory for a 1,000 hours' life test, and the resulting report has just been published. According to this report, the tests show that all the valves were efficient during and after the test, and the results prove that the "P.M." filament is consistent in its electron emission. The report is obtainable from the Mullard Wireless Service Co., Ltd., and a study of it will prove instructive.

The Work of the Electricity Commissioners.

Report for the Year 1925-26. *(Abstract.)*

(*Continued from page* 1032.)

Special Orders.

At the commencement of the period covered by the Report, 79 applications for Special Orders were under consideration, and during the year 93 applications were received. The Commissioners made Special Orders in respect of 70 of the applications before them, and submitted them to the Ministry of Transport for confirmation. Of the rest, 8 were refused by the Commissioners and 6 were withdrawn by the promoters, thus leaving 88 applications still under consideration at March 31st, 1926. Of the 93 new applications received, 58 related to the establishment of new distribution undertakings by existing authorised undertakers and other bodies. As in previous years, a noteworthy feature of many of the new applications was the large extent of the proposed areas of supply. As many as 32 of the applications lodged during the year competed with current or prior applications. During the year, 12 inquiries affecting 22 applications were held by the Commissioners.

Certain of the applications sought distribution powers in respect of areas where bodies or persons (other than the promoters) were already supplying electricity without statutory powers, and representations were made to the Commissioners by such bodies or persons that they would suffer loss if powers were granted to another body. These suppliers had no legal status, but in some instances the promoters of the Special Orders entered into agreements to acquire the non-statutory undertakings as soon as the Orders had come into force. In other cases, however, where the parties were unable to come to terms, when the circumstances appeared to justify an opportunity being given to the non-statutory undertaking to place itself on a statutory footing, the Commissioners retained the area in the Special Order as granted to the promoters, but inserted a clause to the effect that if within a specified period the non-statutory undertaking obtained powers of supply within a defined area in which it was operating, the said area should cease to form part of the area of supply under the Special Order.

As a general policy, the Commissioners would not be disposed to refuse the grant of statutory powers for a well-considered scheme of distribution merely by reason of the fact that supplies of electricity were being given by another body without statutory authority in a portion of the proposed area of supply.

An important class of case came under consideration during the past year, namely, applications for Special Orders to authorise the suspension of the powers of purchase of local authorities, thereby conferring on the company undertakers concerned an extension of tenure in respect of their undertakings. It has been represented to the Commissioners on several occasions that uncertainty as to the intentions of a local authority, when a date of option to purchase is about to mature, has proved detrimental to development, and that company undertakers in the years preceding a possible purchase of their undertaking have felt reluctant to incur further capital commitments or to make voluntary reductions in their charges for electricity owing to the lack of any prospect of a reasonable return in the event of an early cessation of tenure. In these circumstances, the approach of a potential date of purchase has influenced various companies to approach the local authorities concerned with the view of negotiating a basis on which the latter bodies would be prepared to agree to the suspension of their powers of purchase.

Where the consent of the Local Authority is obtained, it is open to the Commissioners, by the grant of a Special Order under the provisions of Section 14 of the Act of 1922, to suspend the purchase powers of the local authority for such period and on such conditions (if any) as they may think fit. It appeared to them that a condition which had been agreed between the parties concerned in some instances, namely, an immediate reduction in the charges made by the company for electricity, could not be regarded as an adequate consideration for a substantial extension of tenure. They came to the conclusion that in normal cases provision, *inter alia*, for a sliding scale of price and dividend should be included in the Order, and an intimation to this effect was given to companies and local authorities which addressed communications to them on the matter.

Inclusive of certain Orders confirmed by the Minister during the period covered by the previous Report, 62 Orders in all were submitted to and approved by Parliament during the year under review.

Sanction to Borrowing by Local Authorities.

At the commencement of the period covered by the Report, 107 applications from local authorities for sanction to borrowing for electricity purposes were under consideration, and during the year 694 further applications were received. Sanctions were issued in 588 cases, and 184 applications remained under consideration at March 31st, 1926.

The total amount of the loans sanctioned during the year was £9,685,301. The total amounts sanctioned by the Commissioners from January, 1920, to March 31st, 1926, aggregated £69,566,918. Of the amount sanctioned during the year, 53.8 per cent. was for mains and services, and 31.6 per cent. for plant. The amount still under consideration at March 31st, 1926, was about £7,423,000.

The total amount sanctioned showed a decrease of about £3,693,700 on the figures for 1924-25. This was mainly attributable to the fact that fewer large schemes of extension formed the subject of applications than in any previous year. The largest amount sanctioned (Edinburgh Corporation) was £465,120. In the previous year, the sanctions issued to four local authorities alone authorised the borrowing of more than £4,000,000.

Special circumstances attended an application by the Wirral Rural District Council, which the Commissioners found it necessary to refuse after inquiry. The Council had been granted a Special Order in 1925 as the outcome of a previous inquiry into a number of competing applications affecting the Wirral Peninsula, and sanction to borrow was subsequently sought by the Council for the purpose of establishing an undertaking under the Special Order. The scheme met with strong local opposition, and, on the evidence given at the inquiry, it appeared that the circumstances had undergone modification since the date when the Special Order application was under consideration. The Commissioners decided that the contemplated scheme did not represent an economical method of developing the district in the altered circumstances, but intimated that their decision should not be regarded as precluding the possibility of a supply of electricity being made available in the district within a reasonable period in a manner less open to the objections attaching to the scheme then contemplated.

The figures for loan sanctions show a progressive increase in the proportion of loans sanctioned for mains and services, and a progressive decrease in the proportion attributable to plant, and reflect in a prominent manner the absence of large schemes of extension of generating plant from the sanctions issued in 1925-26. The figures bear evidence of the substantial programme of replacement and extension which was undertaken by local authorities in the first three years to overtake arrears of development occasioned by war-time restrictions and in anticipation of the further growth in the demand for electricity. In making provision for such growth, capital expenditure was necessarily incurred to a greater extent at the outset for plant than for mains, and as was therefore to be expected during a period of substantial development, expenditure on mains showed a relative increase in the later years.

An informative indication of certain other trends of development in local authority areas of supply is also afforded by the particulars given below.

Particulars of Loans Sanctioned for Certain Purposes.

Year.	Changes of system.	Wiring consumers' premises.	Domestic apparatus for hire.
	£	£	£
1920-21	470	2,500	4,450
1921-22	24,490	5,525	24,304
1922-23	11,394	7,000	11,188
1923-24	6,696	29,450	28,551
1924-25	30,536	24,844	31,071
1925-26	75,153	50,002	83,795

During the year two sanctions were issued by the Commissioners authorising the suspension, for prescribed periods, of sinking-fund payments in respect of moneys borrowed for electricity purposes (Ayrshire Electricity Board and Preston Corporation).

The arrangements made with the Valuation Department for the advice of district valuers to be available to local authorities in connection with the purchase of land for electricity purposes have proved of considerable benefit to local authorities, and the Commissioners emphasise the importance of obtaining valuations from the district valuer before negotiations are commenced for the acquisition of land.

In respect of grants administered by the Unemployment Grants Committee, it fell to the Commissioners, as in previous years, to consider the applications relating to electricity supply. In 70 cases they gave the necessary certificate as to the suitability of the proposed works. The most important of the applications from local authorities related to the change-over of the existing system of supply by the Great Yarmouth Corporation, the amount approved being £120,367. Ten of the applications dealt with were from public utility companies, but grants were approved in respect of two schemes only, involving a total capital expenditure of £4,900.

Mutual Assistance : Bulk Supplies.

Further progress was made with regard to bulk supply developments, the number of bulk supplies taken or arranged being 329. During the year ended March 31st, the Commis

sioners approved of arrangements for mutual assistance in 16 cases under the Act of 1919. In five further applications the proposed arrangements involved the breaking-up of streets, &c., in districts intervening between the areas of supply of the parties. A Special Order was made by the Commissioners in each case.

Under other Acts the Commissioners sanctioned five other arrangements.

Systems of Supply : Regulations.

During the year the Commissioners approved of the adoption by 15 authorised undertakers (in respect of 16 undertakings) of systems of supply other than the general systems previously approved. They issued 15 consents to an alteration in the declared system and/or pressure of the supply hitherto adopted by 14 different authorised undertakers.

A review of the 77 consents given by them during the last six years shows that a considerable measure of success has resulted from the efforts which have been made to secure the elimination of the various odd frequencies in vogue in different portions of the country, and also a change-over from direct-current to alternating-current systems of distribution. Of the consents in question, 14 have been in respect of alterations to the standard frequency of 50 cycles per second from existing frequencies of 25 cycles (two cases); 40 cycles (one case); 60 cycles (three cases); 67½ cycles (one case); 77 cycles (one case); 83¼ cycles (one case); 87½ cycles (one case); 93 cycles (one case); and 100 cycles (three cases). Alterations from d.c. distribution to a.c. distribution formed the subject of 53 consents, of which 47 provided for 50-cycle a.c. systems.

In November, 1925, the Commissioners received from the Incorporated Municipal Electrical Association a report of a joint committee appointed by that Association, and representative also of the Provincial Electric Supply Committee of the United Kingdom and of Constructional Engineers, dealing with the question of low-tension distribution by means of overhead lines, and recommending, *inter alia*, various modifications in the existing code of regulations for overhead lines in relation to low-tension lines.

The report was discussed in detail with a deputation from the Joint Committee. In the course of a subsequent communication to the Incorporated Municipal Electrical Association on the matter, the Commissioners, after intimating that they were anxious to do everything possible to encourage the wider use of electricity in rural and sparsely populated areas and were fully seized of the important bearing of overhead distribution in that connection, pointed out that when considering, in 1920, the question of revising the then existing codes of regulations for overhead lines and the possibility of mitigating requirements (such as those relating to minimum height above ground, factors of safety, conditions of wind pressure, &c.) which advances in technical practice had shown to be unnecessarily stringent and a handicap on development, the Commissioners sought the views of all sections of the electricity supply industry, and that, in effect, the code to which the industry was now subject represented the proposals put forward by the industry itself. There had been no radical change in the circumstances prevailing since the date of approval of the existing code; and having regard to the genesis of that code, they would feel constrained from lightly embarking upon a review of the regulations unless a definite case for amendment in the general interests of electrical development were shown to exist.

With regard to the principal technical points dealt with in the report of the Joint Committee, they pointed out that they were not aware of any change in the conditions which would warrant the reduction, in general regulations, of the present minimum height of 20 ft., as suggested by the Joint Committee; and that it was open to the Commissioners under the existing code to consent to line conductors being placed at a height of less than 20 ft. in cases where they were satisfied that such a course was justifiable.

The recommendation of the Joint Committee as to wind pressure represented a reversion to the basis prescribed by the codes formerly in use; the modification of the former conditions to the present basis was definitely suggested by the Special Committee of the Institution of Electrical Engineers; and, in the circumstances, there did not appear to be a *prima facie* case for an amendment of the existing regulations.

With regard to factors of safety, the factors recommended by the Joint Committee appeared to be higher than those prescribed by the existing code, and the tables relating to the construction of typical overhead lines submitted by the Joint Committee on the basis of their recommendations, on comparison with similar tables prepared by the Commissioners in accordance with the existing regulations, appeared to show that the regulations were not more onerous than would be the case if the amendments recommended by the Joint Committee were given effect to.

In January, 1926, the Commissioners received a communication from the Postmaster-General on the subject of the requirements for the protection of telegraph, &c., lines from electric power circuits at low and medium pressures, which made provision, *inter alia*, for the use of an approved weatherproof covering of insulation for conductors worked at a maximum pressure of 125 volts a.c. or of 250 volts d.c. to earth. The Commissioners were informed that the suggestion had been made that the voltage limits in such cases should be raised to 250 volts a.c. and 650 volts d.c. to earth; and that the Postmaster-General was prepared to give effect to the suggestion if the Commissioners were satisfied with the protection which would be afforded to the public. In reply, the Commissioners informed the Postmaster-General that in their opinion the adoption of the proposed new limits of voltage would not involve an increased risk to the public in the immediate neighbourhood of a danger point, and in April, 1926, the new limits came into force.

Fringe Orders.

The Commissioners granted 106 Orders during the year permitting various authorised undertakers to supply electricity to specific premises situated outside their respective areas of supply, and revoked 8 Fringe Orders where the undertakers had come to an agreement as to taking over the supply.

The question whether an authorised undertaker could give a supply of electricity to the whole of particular premises situated partly within and partly without the area of supply of the undertaker if the service line were taken into that part of the premises situated within the area of supply formed the subject of a decision of the High Court in February, 1926, on an issue raised between the St. Pancras Borough Council and the County of London Electric Supply Company, Ltd. While the terminals of the consumers' installation at which the supply was delivered were situated in the area of the company, the major portion of the supply was admittedly for consumption in the portion of the premises situated in the area of the Council. In the course of the judgment it was held that a distinction was drawn between "supply" and "use" or "consumption"; and that "supply" meant a supply in the sense of delivery at the consumers' terminals.

(*To be continued.*)

The Electricity (Supply) Act, 1926.

A Summary of its Provisions.

The following are the principal clauses in the Electricity (Supply) Act, 1926; the complete text can be obtained from H.M. Stationery Office, price 1s. net. Where possible without materially affecting the sense, the text has been abbreviated or paraphrased.

Constitution and General Powers of Central Electricity Board.

1.—(1) For the purposes of this Act there shall be established a body to be called the Central Electricity Board, consisting of a chairman and seven other members, appointed by the Minister of Transport after consultation with such representatives or bodies representative of the following interests as the Minister thinks fit, namely, local government, electricity, commerce, industry, transport, agriculture, and labour. A member of the House of Commons is not eligible.

(3) The chairman and any whole-time member of the Board shall, within three months after his appointment, sell any securities which he may hold in any company carrying on the business of supplying electricity or the manufacture or sale of machinery or plant for the generation or transmission of electricity; and shall not whilst holding office purchase or hold for his own benefit securities in any such company.

(4) Any member of the Board shall, if he is interested in any company with which the Board has or proposes to make any contract, disclose to the Board the fact, and shall take no part in any deliberation or decision of the Board relating to such contract. Where a member becomes disqualified, or if he is absent from the meetings of the Board for more than six months, except for some reason approved by the Minister of Transport, the Minister shall declare the office to be vacant.

(5) The Board shall be a body corporate with power to hold land.

(7) A person appointed to the Board shall hold office for such term, not less than five years nor more than 10 years, as may be determined by the Minister before his appointment.

(8) There shall be paid to the members of the Board such salaries and allowances for expenses as the Minister of Transport may determine, and to the secretary, officers, and servants of the Board such salaries and, on retirement or death, such pensions and gratuities, as the Board may determine.

2.—(1) The Board shall be charged with the duty of supplying electricity to authorised undertakers in accordance with the provisions of this Act, but shall not, save as hereinafter provided, themselves generate electricity.

(2) It shall be lawful for the Board to enter into arrangements with any authorised undertakers for the delegation to them of any of the powers of the Board which can more expediently be exercised locally.

(3) Where proposals are made to the Board by any association of owners of selected stations within an area for which a scheme has been adopted under this Act, for the delegation to the association of any powers and duties of the Board within that area, the Board shall comply with the proposals if and so far as they consider it practicable to do so, subject to such conditions as they think fit to impose.

(4) The Board shall not delegate any of their powers with respect to selected stations without the consent of the owners of those stations, nor shall they delegate their power of adopting schemes or fixing a tariff.

3.—(1) The Board may appoint one or more consultative technical committees, consisting of engineers employed in connection with selected stations.

Provisions as to Scheme.

4.—(1) The Electricity Commissioners shall, as soon as practicable, prepare and transmit to the Board a scheme or schemes relating to the respective areas specified therein—

(*a*) Determining what generating stations (whether existing or new) shall be the stations (in this Act referred to as selected stations) at which electricity shall be generated for the purposes of the Board;

(*b*) Providing for interconnection, by means of main transmission lines to be constructed or acquired by the Board, of selected stations with one another and with the systems of authorised undertakers, and, where the scheme relates to a specified area, for interconnection by means of such lines of the system of the Board in that area with the system of the Board in any other area with respect to which a scheme is then in force or may subsequently be made;

(*c*) Providing for such standardisation of frequency as may be essential to the carrying-out of such interconnection.

(*d*) Enabling or requiring temporary arrangements (to be in force during the carrying-out of the works specified in the scheme) to be made between the Board and owners of generating stations (whether authorised undertakers or not) with respect to the giving and taking to and by the Board of supplies of electricity, and with respect to the working of generating stations (whether selected stations or not) by the owners thereof;

(*e*) Containing such supplemental, incidental, and consequential provisions as may appear necessary or expedient for any of the purposes aforesaid:

Provided that neither a railway generating station operated by a railway company at the date of the passing of this Act, nor a generating station belonging to any canal, inland navigation, dock, or harbour undertakers, and operated by the owners thereof at the date of the passing of this Act, nor a private generating station, shall, without the consent of the owners thereof, be included in the scheme as a selected station, nor shall the owners of such a station be required to enter into any temporary arrangements under a scheme, and the scheme shall not authorise the acquisition of a main transmission line belonging to any such undertakers or the owners of a private generating station without the consent of the owners thereof.

(2) The Board shall cause every scheme to be published, and shall give public notice of the date (not less than one month) by which authorised undertakers and other persons interested may make representations thereon; and the Board, after considering the scheme and such representations, and after holding such inquiries (if any) as they think fit, may adopt the scheme either without modifications, or subject to such modifications as they think fit, and either generally or as respects any part of the area specified in the scheme, and shall publish the scheme as so adopted by them, and where the scheme has been adopted as respects part of the said area it may subsequently be adopted as respects other parts of the area.

(3) As soon as a scheme is so adopted and published it shall be the duty of the Board to carry out and give effect to the scheme:

Provided that if any authorised undertakers on whom obligations are imposed by the scheme consider that the carrying-out of those obligations would be prejudicial to them they may, within one month after the publication of the scheme as adopted, by notice in writing, specifying the nature of the complaint and of the relief sought by them, require the Board to refer the matter complained of to the arbitration of a barrister (or in Scotland an advocate) qualified for appointment to judicial office, appointed by the Minister of Transport from panels to be set up by the Lord Chancellor and the Lord President of the Court of Session respectively for the purpose, and the Board shall refer the matter accordingly, unless they amend the scheme by relieving the complainants of such obligations as aforesaid, and shall not, pending the determination of the complaint, unless the complaint is one with respect to which no relief other than pecuniary compensation can be awarded, carry the scheme into effect so far as it affects the complainants.

(4) The arbitrator to whom any such matter is so referred may call in qualified assessors and hear the case with their assistance, and may, if satisfied as to the justice of the complaint, either order such pecuniary compensation to be made to the complainants as seems equitable in all the circumstances or order the scheme to be amended in such manner as he may direct:

Provided that the arbitrator shall not grant any relief other than pecuniary compensation in any case where the Board certify that the grant of such relief would conflict with the basic principles of the scheme or would prejudicially affect the efficiency of the scheme.

(5) A scheme may be altered or extended by a scheme made and adopted in like manner as the original scheme:

Provided that a generating station included in a scheme as a selected station shall not cease to be a selected station without the consent of the owners thereof.

5.—(1) The Board shall make arrangements with the owners of existing generating stations which by virtue of a scheme are to become selected stations for the stations being operated in accordance with the provisions of this Act, and for such extensions and alterations thereof as may be required by the scheme, and for such additional extensions and alterations as the Board, with the approval of the Electricity Commissioners, may from time to time direct:

Provided that if the owners of any such station consider that any directions of the Board requiring additional extensions or alterations impose upon them an unreasonable financial burden, the matter shall, if they so require, be referred to the arbitration of a barrister as in Section 4.

(2) If the owners of any such station are unwilling to enter into or fail to carry out any such arrangements to the satisfaction of the Board, the Minister of Transport may by order empower any authorised undertakers or other company or person approved by the Board, or, failing such authorised undertakers, company, or person, the Board, to acquire the generating station at a price to be determined in accordance with the provisions of the First Schedule to this Act; but where the generating station is situate in an electricity district for which a joint electricity authority has been constituted, that authority shall be given first opportunity to acquire the station, and on payment or tender of such price the Minister of Transport may make an order vesting the generating station in the authorised undertakers, company or person, or the Board:

Provided that an order under this subsection authorising the acquisition of a generating station shall not come into force until it has been laid before each House of Parliament for a period of not less than thirty days on which that House has sat, and if either House before the expiration of that period presents an address to His Majesty, no further proceedings shall be taken thereon.

(3) Where the Board acquire a generating station under this section, they may carry out such extensions or alterations thereof as are required by the scheme or as they think fit, and may either operate it themselves or make arrangements with any authorised undertakers or other company or person to operate it:

Provided that the Board shall not themselves operate such a generating station unless they satisfy the Electricity Commissioners that they are unable to enter into an arrangement with any authorised undertakers or other company or person to operate it on reasonable terms, and where the generating station is situate in an electricity district for which a joint electricity authority has been constituted, the Board shall first endeavour to enter into arrangements with that authority to operate the station.

6.—(1) The Board may make arrangements with any authorised undertakers in whose area of supply, or in the neighbourhood of whose area of supply, any new generating station required by a scheme is to be situated, for the provision of such station, but where such area of supply is situate in an electricity district for which a joint electricity authority has been constituted, the Board shall first endeavour to enter into arrangements with the authority for the provision of such station.

(2) If the Board satisfy the Electricity Commissioners that they are unable to enter into an arrangement with any such authorised undertakers for the provision of any such new station on reasonable terms, the Commissioners may by a special order authorise the Board or any company or person to provide the station.

(3) Where the Board themselves provide a new generating station, they may operate it themselves, or make arrangements with any authorised undertakers or other company or person to operate it:

Provided that the Board shall not themselves operate such a generating station unless they satisfy the Electricity Commissioners that they are unable to enter into an arrangement with any authorised undertakers or other company or person to operate it on reasonable terms.

7.—(1) As from such date as may be fixed by the Board, the owners of a selected station shall be under the obligation—

(*a*) To operate the station so as to generate such quantity of electricity, at such rates of output, and at such times as the Board may direct, and to conduct such operations with due regard to economy and efficiency;

(*b*) To sell to the Board all electricity generated at the station at such price as is hereinafter mentioned.

(2) The owners of a selected station shall be entitled to be supplied by the Board from that station with such amount of electricity as they may require for the purposes of their undertaking.

(3) The price to be paid by the Board for electricity shall, unless otherwise agreed, be the cost of production.

(4) The price at which electricity shall be supplied by the Board from a selected station to the owners of that station shall, unless otherwise agreed, be either—

(*a*) The cost of production, together with a proper proportion of the Board's expenses; or

(*b*) According to the tariff fixed under this Act for the supply of electricity by the Board;

whichever is the lower.

(6) If any question between the Board and the owners of a selected station arises under this section, then, if it relates to the cost of production, it shall be determined by an auditor appointed by the Minister of Transport, and in any other case it shall be determined by the Electricity Commissioners.

8.—(1) After a scheme has been adopted as respects any area or part of an area, the Board shall construct and lay down the main transmission lines required for the interconnection of selected stations with one another and with the systems of authorised undertakers in accordance with the scheme, so far as it relates to that area or part of an area.

(2) Where a scheme provides for the acquisition by the Board of any main transmission line belonging to any authorised undertakers, such line shall on payment vest in the Board upon an order to that effect being made by the Minister of Transport.

(3) The Board shall defray the reasonable expenses incurred by the undertakers in effecting necessary alterations, and any question shall in default of agreement be determined by an arbitrator appointed by the Minister of Transport.

(*To be continued.*)

Electrical Accidents in Mines.

(Report of H.M. Electrical Inspector of Mines for the Year 1925.—*Abstract.*)

THE Report of H.M. Electrical Inspector of Mines has recently been issued (H.M. Stationery Office, price 6d. net), and the following is a summary of its contents:—

The two specifications referred to in the previous year's report, ELECTRICAL REVIEW, August 28th, 1925, p. 351, covering the flame-proof enclosure of electrical apparatus and flame-proof plug connectors, had not at the end of 1925 been published, but they have since been reported to the Sectional Committee for Colliery Requisites, and it was hoped that they would be issued during 1926.

Towards the end of the year work was commenced on the revision and amendment of an existing British Engineering Standards Association specification for flame-proof air-break switches.

The rate of progress in the preparation of the specifications depends very largely upon securing at each meeting a full attendance of the members of the panel.

It is proposed to add to the specification for flame-proof air-break switches, and to any similar specification, an explanatory appendix, there being considerable ignorance and not a little indifference on this subject even where apparatus is procured for use in places where inflammable gas is known to be a possible risk.

Five storage battery vehicles were submitted to tests in a competition held during the year upon an experimental track constructed on the surface at Brodsworth Colliery, near Doncaster, and useful records of performance were obtained; Messrs. Joseph Booth & Bros. were awarded a prize of £1,000.

At the end of the year 1,589 mines using electricity were at work out of a total of 2,721, as compared with 1,630 out of a total of 2,855 at the end of 1924. The total h.p. installed was 1,556,235, against 1,481,932 h.p. for the previous year. The respective percentages of the h.p. installed below and above ground were 54 and 46. The average h.p. installed per mine in 1925 was 979, against 909 for 1924. The average size of the colliery installation ranged from 204 h.p. in the district of South Staffordshire and Worcestershire, to 2,097 h.p. in Kent. Less than 59 per cent. of the mines at work had electrical installations, the lowest proportion being 14 per cent. in the district of Shropshire, rising to 100 per cent. in Kent.

During 1925 there were eight fatal accidents attributed directly or indirectly to the use of electricity. Seven of these were simple cases of electric shock, and in one instance two lives were lost, making a total of eight deaths. The remaining accident was concerned with an ignition of firedamp at a machine-cut coal face, which was attributed to open sparking at the plug connector of an electrically-driven coal-cutting machine. Sparking had occurred at the plug contacts within some recent period. Five lives were lost in this accident, making the total number of deaths for the year 13. Of the fatalities due to electric shock, two accidents occurred below ground, involving three lives, and five above ground, each of these involving one life.

Summarised Account of Electrical Accidents resulting in Loss of Life during 1925.

1. *Fernhill Colliery, Glamorgan.*—Two miners, a haulier and a collier, were killed by electric shock received from the bare signal circuit wires while they were walking out of the mine, a 550-V power line having broken down and come in contact with the signal wires.

2. *Wath Main Colliery, Yorks.*—One man was killed and two others received shocks when the tipping screws of a 4-ton end-tipping lorry came into contact with the insulated conductors of a temporary overhead line at 500 volts.

3. *The Fife Coal Company, Limited.*—An electrical linesman was killed by shock while engaged in reconnecting a cable at the switchboard in the Central Power Station at Kelty. It is evident that he had touched some live terminals at 3,300 V.

4. *Pentre Colliery, Glamorgan.*—A linesman was killed by climbing into contact with bare conductors on a lattice mast forming part of a 6,000-V, 3-phase transmission line.

5. *Edward Pit, Wallsend, Northumberland.*—Five men were killed, one man received slight injuries, and 27 others were affected by afterdamp following an explosion of firedamp at a longwall coal face. The face was cut by an electrical chain-type machine, and there was evidence of electrical arcing between the tips of the contact pins on the machine and the lips of the sockets in the plug connector.

6. *Bertie and Trefor Colliery, Glamorgan.*—A telpher driver received a shock from 440-V bare trolley wires while mounted on a ladder; he fell and was killed.

7. *Bardykes Colliery, Lanark.*—A coal-cutting machine man received a fatal shock while withdrawing a live trailing-cable plug, 500 V, from the machine end.

8. *Manor Powis Colliery, Stirling.*—A picker on the screens was killed by accidentally clutching some cotton-covered 250-V lighting wires.

Non-fatal Accidents and Dangerous Occurrences.

During the year 54 cases were notified of non-fatal electrical accidents and dangerous occurrences, as compared with 57 in 1924 and 70 in 1923. The numbers include ignitions of fire-damp attributable to "open-sparking." Of these accidents 34 occurred below ground and 19 above ground at mines under the Coal Mines Act, and one at a slate mine. In each instance some personal injury was caused, affecting in all 64 persons, to which number must be added six persons injured non-fatally in two of the fatal accidents previously recorded, making a total of 70 persons. There were no reported instances of fire due to electrical causes below ground, but included in the total are two cases of the ignition of fire-damp which caused injuries to nine persons, and one instance of an exploded switch case above ground. Explosions of electrical apparatus are not at present notifiable unless they happen to cause personal injury or result in a fire below ground, but notice was received of three explosions of switchgear in use below ground which are not included above for that reason.

Inadequate maintenance, together with ignorant misuse and negligence, were, as usual, the most important contributory causes. Maintenance is primarily a matter of organisation, and a reduction in the number of accidents which are fairly attributable to faults of maintenance lies in the hands of the management of the mines. Where the staff is insufficient, not only will the number of accidents be relatively high under this heading, but there will be avoidable interruptions of the service and a progressive, if at first imperceptible, deterioration of the installation. Accidents due to deliberate misuse or to negligent operation of apparatus can be controlled to some extent by establishing a high standard of discipline, but their root cause lies in the ignorance of the individual.

Application of Coal-Cutting Machines.

Approximately 30 million tons of coal were got by 3,134 electrical coal-cutting machines in 1925, out of a total of slightly more than 48 million tons got by machine cutting. In view of the admittedly superior performance and economy of the electrical machine, it is perhaps remarkable that the proportion of machines driven by electricity has remained practically stationary. Perhaps the most cogent reason for this is the wise reluctance of the management to introduce electricity into places where firedamp is a potential danger. British designers and users now have for the first time definite and authoritative guidance in flameproof enclosure protection as a result of the research which has been carried out by Dr. Wheeler and his associates, under the auspices of the Safety in Mines Research Board and at the instance of the British Electrical and Allied Industries Research Association. There remains, however, the problem of ensuring that electrical equipment which is initially safe shall continue in that condition in use. This is essentially a matter of organisation within the control of the colliery management, and the colliery manager is the person who is best placed to judge whether the standard of discipline and maintenance at the mine under his charge is adequate for this purpose, and whether the normal ventilation considered in relation to the physical conditions of the mine can reasonably be relied upon to eliminate the risk of a coincident accumulation of firedamp in dangerous quantity and a failure of the electrical equipment.

Assuming a satisfactory solution of the twin problems of design and maintenance of flame-proof apparatus, there re-

mains the risk of a defect in the cables. Little has been attempted so far in the evolution of a cable that is proof against the risk of "open sparking" under fault conditions, but perhaps the crux of the matter lies in the automatic protection of the circuit. Mere overload protection cannot be depended upon to prevent "open sparking" on a cable of normal design under all fault conditions, but there is ground for hoping that leakage protection designed and applied to that end would prove effective, subject to the correlative provision in the cable of an earthed metal screen around or between the live conductors.

Firedamp Explosions with Electrical Origin.

The following is a summary of some of the explosions which have occurred under the above heading during the period 1914-1925. In one case commutator sparking caused, through the flanges of a loose commutator cover, ignition of a feeder of gas; no bolts or studs were missing, but two studs that should have been screwed down tightly were left loose owing to lack of room and height for manipulating a key. A feeder of firedamp was ignited by sparking at the commutator or controller of a machine; three studs were missing from the motor, and at the controller there were two holes about 1 in. in diameter. Gas was ignited by the normal sparking at the commutator of a machine; out of six bolts for securing the commutator cover, only one was in place, and the joint or seating of the cover was not flameproof.

A heading machine on being started caused an ignition of gas; one bolt was missing from the commutator cover, leaving a ¼-in. diameter opening, and one stud was missing from the flange of a pipe enclosing the cables to the switch, leaving an opening ½ in. wide between one side of the flange and its seating. Heavy flashing from the controller caused an explosion of gas outside a machine; the design of the controller and casing was very poor, the lid being ⅜ in. iron, 16 in. by 8 in., held down by five studs, with thin rubber insertion for fitting. Flashing at the switch or slip rings of a machine caused an explosion of firedamp and inflammation of dust when the current was being switched on; the machine was not flame-proof, as 10 out of 17 studs and bolts required to make it so were missing; seven of the holes thus left were ½ in. in diameter, and any one of these would suffice to allow passage of the flame of an internal explosion. Gas was ignited by the break-flash at the switch contacts of a machine; the enclosure of the machine had been rendered ineffective by wear and by alterations following repairs. Gas was ignited by the break-flash at the switch in a switch box; the flame-proof baffles had been omitted from the ventilating openings in each end of the motor, and there was an opening designed for the passage of cables between the switch-box and the motor carcase. Gas was ignited by the break-flash in a switch-box. The box was not designed so as to be flame-proof and was imperfectly maintained; the cover for the commutator end of the motor was likewise unsuitable in design. An explosion of firedamp was caused by the absence of two ⅜-in. set screws from the cover of a machine switch-box. Gas was ignited, probably by the normal sparking at the contacts of an air-break star-delta starting switch on a longwall chain-type machine; no bolts were found to be missing, but the enclosure of the switch-box, due to wear and to alterations made at the colliery, was not flame-proof. A disk machine driven by a slip-ring 3-phase motor was in use when gas was ignited, probably by the normal sparking at the reversing switch contacts; one ¼-in. set screw was missing out of four used for fixing the plug-box base to the side of the switch-box, the front cover plate of which was insecurely attached, one screw being missing and the thread of another was stripped. Flashing from the controller, or arcing at the machine trailing cable "bat" caused an explosion of gas; the "bat" or connector was wedged into the machine socket by a piece of wood instead of being held fast by the proper holding-down pin provided, while seven of the eight studs in the controller cover were missing. Firedamp was ignited while current was being switched on a machine; the probable cause of the ignition was open sparking between the pin and socket contacts of the plug connector, which was of imperfect design and in a defective condition A machine was being prepared for flitting, and when restarted after setting the haulage prop an explosion occurred, probably by sparking due to bad contact between the pins and sockets of the plug connector, which showed signs of burning; the controller was oil-immersed. A hole was burned through the trailing cable "bat" at a machine and an explosion of firedamp and dust took place; two studs of the switch casing were loose, but the explosion was most likely caused by arcing inside the "bat" or connector; the concentric system was in use. A concentric trailing cable, while being handled at the coal face, "burst" and ignited gas. A trailing cable coupled to a machine "burst" at a point where it had been repaired, and ignited gas; as the incident occurred at the end of the shift, the machine men were not in the vicinity at the moment and escaped injury. A stone fell upon a concentric trailing cable causing it to "burst" and ignite firedamp. A cab-tire trailing cable, passing over the top of a coal cutter, was so damaged by the movement of the ratchet lever that flashing resulted and firedamp was ignited. A fall of roof on to a cab-tire trailing cable lying on the top of a coal cutter caused a flash which ignited gas from a break.

The report concludes with tables indicating the use made of electricity in metalliferous mines only, there being no such statistics relating to quarries. One table shows the aggregate horse-power of motors installed for the various purposes for which electricity is used during the last five years, while in another table, covering the same period, the classification is regional and summary.

The advantages of electrical power to the metalliferous mining engineer do not need to be particularised here, but nevertheless where the opportunity occurs the convenience and economic advantage of the electric motor compel its adoption and even the patriarchal Cornish pump is giving place to the electrically-operated centrifugal or turbine pump. Storage-battery locomotives are at work in two ironstone mines which are governed by the Coal Mines Act, and in four mines under the Metalliferous Mines Act, and speaking from observation, it would appear that they might find a field for application in gypsum mines, where the gradients are easy while the roadways are tortuous, as an economically advantageous substitute for animal traction. Success with these vehicles is largely dependent upon the skill and intelligence, one might almost say the sympathetic understanding, with which the batteries are cared for. The purely electrical and mechanical, as distinct from the chemical component, parts of the storage-battery vehicle, are at the present day quite equal to the service that would be required of them. There were no electrical accidents during the year at quarries and only one of a trifling nature at a slate mine.

Legal.

Theft of Lamps.

AT Coventry, last week, William E. Faulkes, electrician, was sentenced to three months' imprisonment, with hard labour, for obtaining 12 electric lamps, value £1 17s. 6d., by false pretences from Edith Holroyd. He had represented that a contractor had sent him who would call at the shop next day and pay for them. Simon Kunes, general dealer, was fined £5 for receiving the lamps from Faulkes. Kunes paid 4d. each for them and sold them for 2s. each. He pleaded he bought them as old stock.

Electric Holdings, Ltd.

MR. JUSTICE EVE, in the Chancery Division, on December 21st, confirmed an alteration of the memorandum of association of this company, and also confirmed a reduction of capital. Mr. GORDON BROWNE, for the company, said it was only a slight alteration of the objects that was proposed. The reduction of capital was to be effected by cancelling 575,000 ordinary shares, which were all owned by Vickers, Ltd. His LORDSHIP approved the alteration and the proposed reduction of capital.

National Wireless Corporation, Ltd.

A PETITION by P. H. Camp for a compulsory order to wind up this company came before Mr. Justice Eve in the Chancery Division on December 21st. Mr. LAVINGTON, for the petitioner, said his client was a judgment creditor, and the company did not appear. His LORDSHIP granted the order.

Electrification of Balloon Fabrics.—The Aeronautical Research Committee has published (H.M. Stationery Office, 9d. net) Reports and Memoranda No. 1,017 (M37), by Dr. Guy Barr, which describes experiments undertaken with the object of finding a method of making the surface of balloon fabrics conducting, and to investigate the electrification produced by the ripping of rubbered fabrics. Samples of various fabrics sprayed by the Schoop method with metallic aluminium and with zinc have been examined, particularly with reference to the permanence of the conducting layer. Alternative methods of producing a conducting surface have been tried, and the conductivities of a number of materials representing current practice have been measured. Two and three-ply rubbered balloon fabrics have been separated into plies and also broken as a whole in apparatus permitting of the examination of the resultant charge, and also in an atmosphere of hydrogen and air. The results obtained indicated that spraying with metal gives a layer of low electrical resistance (3-7 ohms per cm.^{2}) at the cost of an increase in weight of 4 oz./sq. yd. or more; the resistance is liable to increase if the material is crumpled, but falls to a low value if a potential of 10-100 volts is applied. If the coating is impregnated with dope this recovery eventually becomes impossible. Fabric doped on the upper surface after having been sprayed on the under surface was satisfactorily conducting after five months' exposure. The most satisfactory treatment so far discovered, involving only small increases in weight, consists in the application of graphite in the form of an "Aquadag" suspension; a weight of some 3 gm. per sq. metre gave a resistance of 0.03 to 2 megohms/cm.^{2} which was not much increased by doping; and with a weight of 4 or 5 gm./m.^{2} a resistance of 3,000 ohms/cm.^{2} was obtained after doping. When the plies of a rubber-proofed two-ply fabric are rapidly separated the cotton surface left bare becomes positively charged, the rubber attached to the other ply being negatively charged. The extent of electrification varied in different experiments, the maximum observed being of the order of 4,000 electrostatic units per sq. metre of separation.

Tramways and Light Railways in 1925-26.

Annual Return.

THE Ministry of Transport has issued its annual return of tramways and light railways (street and road) and railless trolley undertakings for 1925-26 (Stationery Office, 15s. net). The return covers the whole of 1925 in the case of company undertakings, while for municipal systems the period is the year ended March 31st or May 31st, 1926.

The statistics relate to 241 undertakings (170 municipal and 71 company). During the year the powers of the Chadderton Urban District Council lapsed; the Sunderland District Co. ceased to operate tramways; and the Morecambe Tramways Co. ceased operation and went into liquidation. The Hartlepool Corporation purchased the Hartlepools tramway undertaking, and the Middleton Tramways Co.'s system was purchased by the Corporations of Middleton, Oldham, and Rochdale, while the Grimsby Corporation commenced to operate a portion of line acquired from the Grimsby Tramway Co.

Out of a total of 2,786 route miles authorised, 2,602 miles were open to traffic, 1,888 miles being operated by local authorities and 714 miles by companies. The track mileage was 4,397. The figures showed little alteration of the previous year's position. While the number of car-miles run increased by 2.53 per cent. to 387,812,970, the number of passengers carried increased by only 1.05 per cent.—to 4,668,812,206. The number of car-miles worked electrically was 386,380,636, or 99.63 per cent. of the total. The total amount of energy used was 744,820,194 kWh, and the number of kWh consumed per car-mile was 1.93, as compared with 1.88 in 1924-25. The average fare paid per passenger was 1.43d., as against 1.47d. in the preceding year.

The traffic receipts and expenses of the undertakings are analysed in a table. It is shown that the gross receipts per car-mile again declined—from 18.23d. to 17.44d. The gross working expenditure fell from 14.43d. to 13.97d.; thus the net receipts declined from 3.80d. to 3.47d. The analysis shows that the net receipts of municipal undertakings were reduced from 3.87d. to 3.62d., while those of the company undertakings fell from 3.50d. to 2.64d.

The combined accounts of all undertakings show a total capital expenditure of £96,660,086 (municipalities £76,761,999; companies £19,898,087). The total income during the year was £28,211,355 (municipalities £23,918,622; companies £4,292,733), and the total working expenses were £22,598,617 (municipalities £19,009,122; companies £3,589,495), leaving a gross profit of £5,612,738 (municipalities £4,909,500; companies £703,238). The total available for appropriation, after deducting rents of lines, was £7,034,352, and the total appropriations were £6,998,879. The local authorities were left with a deficit of £979, while the companies had a credit balance of £36,452. The municipal systems drew upon the rates to the extent of £418,933, while they contributed £342,049 to rate relief, the balance being £76,884. The ratio of expenditure to receipts in the case of local authorities was 79.47 per cent., as compared with 78.88 per cent. in the preceding year, and in the case of companies it was 83.62 per cent., as against 80.26 per cent. The combined ratio rose from 79.11 to 80.10 per cent.

The usual practice is followed of grouping the 170 municipal undertakings into classes. Class 1 covers those undertakings which showed a credit balance after meeting all expenses, including capital charges; there were 104 of these, as against 99 in 1924-25, and their combined balance was £400,161, as against £419,708. Class 2 comprises undertakings which, after meeting working expenses and capital redemption charges, made allocations to reserve in excess of the balance; these rose from 6 to 7, and their combined deficit from £108,824 to £159,276. Class 3, undertakings which met working expenses, interest, and capital redemption, but failed to pay income tax and other appropriation charges in full, remained at 15 (deficit £34,339, against £38,342). Class 4, able to cover expenses and interest, but not capital redemption and other charges, fell from 20 to 18 (deficit £40,265, against £46,394). Class 5, unable to meet interest charges in full, declined from 8 to 6, and the adverse balance from £296,437 to £172,582. Class 6, including systems unable to meet working expenses, numbered 9 (against 8), but the deficit fell from £212,618 to £204,834. The "overall" result was a debtor balance of £211,135, as compared with £282,907 in 1924-25.

The section devoted to railless-trolley undertakings shows that there were 18 local authorities and one company who actually carried passengers during the year. Nineteen municipalities did not exercise their powers, and Brighton was deleted. The municipal undertakings of Barrow-in-Furness, Bolton, Darlington, Southend-on-Sea, and Wigan appear for the first time. The route-mileage open for traffic increased from 57.48 to 68.36 (municipalities 65.45), and the passengers carried from 24,261,748 to 33,703,703; the car-mileage rose from 2,670,562 to 3,682,306. An analysis shows that the gross receipts fell from 14.27d. to 13.96d. per car mile, and the gross expenditure from 12.10d. to 11.86d., reducing the net receipts from 2.17d. to 2.10d. The combined accounts show a total capital expenditure of £545,708 (municipalities £528,616). The operating ratio fell from 84.98 to 84.83 per cent. (companies 104.43; municipalities 84.42).

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925

14,884. "Sound-signalling installations." J. P. Northey. June 8th, 1925. (262,158.)

19,587. "Electrical resistances." A. Dilger. August 4th, 1925. (Cognate application 28,103/25.) (262,164.)

20,602. "Electric lamps." W. Dawson and D. M. Milner. June 10th, 1926. (262,166.)

21,324. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). August 25th, 1925. (262,169.)

21,369. "Process for finishing panels for radio sets." P. M. Hennegan. September 13th, 1924. (239,844.)

21,503. "Electric heating bodies for high-temperature furnaces." Studienges für Wirtschaft & Industrie. August 28th, 1924. (239,222.)

21,636. "Electrical soldering-iron with interchangeable copper bit." S. Percival (Zeva Elektricitats Akt. Ges.). August 28th, 1925. (Convention date not granted.) (239,233.)

21,858. "Telephone systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). September 1st, 1925. (262,177.)

22,130. "Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and W. G. Patterson. September 4th, 1925. (262,182.)

22,131. "Electrical switches." W. S. Thimblethorpe. September 4th, 1925. (262,183.)

22,352. "Apparatus for supplying high-tension current to wireless receiving apparatus from alternating current supply mains." S. G. Thaine. September 7th, 1925. (262,190.)

22,839. "Feeding of alternating-current systems by asynchronous generators." Siemens-Schuckkertwerke Ges. September 13th, 1924. (239,881.)

23,255. "Collapsible frame aerials." Igranic Electric Co., Ltd., and G. F. Dandridge. September 17th, 1925. (262,199.)

23,938. "Electric switches such as are used in automatic telephone systems." Siemens Bros. & Co., Ltd., W. G. Patterson, and H. Richmond. September 24th, 1925. (262,207.)

24,229. "Submarine cable telegraph systems." Standard Telephones and Cables, Ltd. (Bell Telephone Laboratories Inc.). September 29th, 1925. (262,209.)

24,419. "Means for the grid back coupling of valve transmitters." Telefunken Ges. für Drahtlose Telegraphie. October 1st, 1924. (240,848.)

24,633. "Variable electric condensers and the like." E. J. L. Delfosse. October 3rd, 1925. (262,215.)

24,723. "Electrically-connecting electrical devices." T. G. Farish. October 5th, 1925. (262,216.)

25,638. "Direct-current motors." F. Newton. October 14th, 1925. (262,226.)

25,746. "Wireless valve-holders." J. C. Ecclestone. October 15th, 1925. (262,228.)

26,641. "Dials of variable condensers, variometers, and the like." A. E. Moore. October 24th, 1925. (262,229.)

24,943. "Telephone receivers." E. French. November 26th, 1925. (Cognate application 32,479/25.) (262,255.)

30,134. "Electric burglar alarms." H. Eisler and G. W. Eisler. November 28th, 1925. (262,257.)

30,423. "Reactance-coil and like supports." J. B. Murray. December 2nd, 1925. (262,261.)

30,776. "Apparatus for producing code messages in electric Morse signals, specially for use in learning and practising the reading of such signals." C. Mills. December 5th, 1925. (262,268.)

31,649. "Manufacture of electric condensers." B. Hesketh. December 15th, 1925. (262,272.)

32,870. "Earth connections for electric conductors." A. Eley and A. M. Ryeland. December 30th, 1925. (262,281.)

1926.

1,692. "Electric incandescent lamps." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 20th, 1926. (262,288.)

1,694. "Electric incandescent lamps." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 20th, 1926. (262,289.)

2,525. "Construction of electrically-operated ladle cranes for steel foundries and the like." Ateliers de Constructions Electriques de Charleroi. December 28th, 1925. (Addition to 249,815.) (262,295.)

2,848. "Hydro-electric power plants." English Electric Co., Ltd., and P. Deriaz. February 1st, 1926. (262,298.)

6,790. "Indicating device for electric currents." J. G. Vincent and J. O. Cole. March 11th, 1926. (262,311.)

7,960. "Electric furnaces." British Thomson-Houston Co., Ltd. March 23rd, 1925. (249,566.)

9,595. "Electrical circuit-breakers." Metropolitan-Vickers Electrical Co., Ltd. April 15th, 1925. (250,937.)

9,942. "Apparatus and means for testing the capacity of electrical condensers." Dubilier Condenser Co. (1925), Ltd. April 14th, 1925. (250,957.)

10,068. "Electric meters of the induction type." International General Electric Co. Inc. April 16th, 1925. (250,964.)

11,302. "Methods of and means for testing magnetic cores made from powdered material." International General Co. Inc. April 29th, 1925. (251,642.)

11,605. "Means for paralleling alternating-current machines or circuits." International General Electric Co. Inc. May 16th, 1925. (252,145.)

11,415. "Electrical deposition of organic materials." Kodak, Ltd. June 8th, 1925. (253,085.)

12,354. "Electric circuit-controlling devices." British Thomson-Houston Co., Ltd. May 16th, 1925. (252,185.)

14,561. "Electric motors." R. Longue. June 9th, 1925. (253,538.)

14,770. "Method of producing glass suitable particularly for insulating purposes." Patent Treuhand Ges. für Elektrische Gluhlampen. August 1st, 1925. (256,189.)

15,879. "Electric motor controllers." R. H. Barbour and J. R. Walton. August 25th, 1925. (Cognate application 15,882/26. Divided application on 21,263/25.) (262,342.)

16,739. "Electrodes for space current devices." British Thomson Houston Co., Ltd. July 8th, 1925. (255,038.)

16,898. "Electric furnaces." Studien Ges. für Wirtschaft U. Industrie. August 27th, 1925. (Divided application on 239,222. Addition to 239,222.) (254,736.)

17,849. "Method of winding electric transformer and the like coils." International General Electric Co. Inc. July 18th, 1925. (255,478.)

17,963. "Electrodes for the electric purification of gas." Siemens-Schuckertwerke Ges. July 18th, 1925. (Addition to 237,262.) (255,490.)

18,034. "Articulated coupling adapted to permit misalignment of two shafts especialy for power transmission in electric railway vehicles." Maschinenfabrik Oerlikon. September 16th, 1925. (258,555.)

18,257. "High-voltage direct-current electrical systems." Metropolitan-Vickers Electrical Co., Ltd. July 24th, 1925. (255,879.)